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TILLAGE MEASURES FOR INCREASING THE CARRYING-CAPACITY OF FARMS.

By J. BROWN, B.Sc., N.D.A., Central Development Farm, Weraroa.

IN the October, 1917, issue of the *Journal* the extension of cropping and fodder conservation was advocated as a means of meeting anticipated war-emergency increases in the stock carried on farms. Apart from the war phase of the situation the need for such measures has been amply demonstrated by the prevailing shortage of feed and consequent stock-losses during the past severe and prolonged winter. Nor should one overlook the losses in young stock which have been occasioned as much by the innutritious and disease-inducing herbage of old and foul pastures as by actual feed-scarcity. The remedy is plain, and action is urgent. Tillage, the growth of suitable crops, and the renewal of pastures are the only expedients by which stock-carrying may be increased and the thrift and profitability of flocks and herds promoted. The uncertainty of the shipping position and the impossibility of gauging it far ahead also warrants all reasonable precautionary measures to meet a possible abnormal carry-over of stock—particularly sheep stock—during the ensuing winter.

From weaning-time on to March or April, lambs that have to be carried forward as hoggets should have the best of fresh, clean pasturage with plenty of range. The reservation in advance of suitable grazing of this description well merits attention. Given a summer rainfall of

average amount and distribution, 1 bushel of Italian rye-grass and 5 lb. of red clover per acre, sown as late as the end of the present month among spring oats after being grazed back, and well rolled in, will provide ideal feed for lambs from February onwards, as well as rebuilding the fertility of the land prior to a more permanent sow-out of pasture. It must be admitted that this practice is somewhat chancy, but, on the whole, failure is worth risking if fresh pasture is likely to be at a premium in autumn.

To renew worn-out pastures it is questionable if a more satisfactory procedure could be adopted than to take a crop of rape to be fed off up to March, and followed then by a sow-out of grass and clover seed, after suitable preparation. Some farmers prefer turnips to precede pasture, but even an early crop of turnips throws the pasture seeding late; whereas the best pastures, other things being equal, are those got by early autumn sowing. Much of the typical arable sheep-country which tends to run in time largely to danthonia can be satisfactorily renewed by ploughing up in December, working well, and resowing as early as possible in autumn. If the sow-out mixture contains, say, 10 lb. of Italian along with the other usual constituents, the pasture will easily carry over double the stock as compared with its carrying before taking up and relaying, and do the stock better in every way. Such procedure can be commended to farmers who are faced with the possibility of having to winter more stock than usual, or whose previous plans have not provided for a regular autumn access of young pasture in sufficient amount. There is an advantage in this method in another direction, in that on light sheep-country sorrel and weeds are less likely to be troublesome than when intermediate cropping—particularly oat-cropping—is practised.

For the carrying of sheep stock generally the main reliance must of course be placed on roots. Something of a succession in root-cropping may with advantage be observed. Different districts have different predilections as regards varieties, but the following has a fairly general adaptation, for the North Island at any rate: Lincolnshire Red Globe, Red Paragon, or Purple-top Mammoth, sown about the beginning of November, for February feeding; Hardy or Imperial Green Globe, sown in mid-November, for March feeding; and Fosterton Hybrid or one of the Aberdeens, sown at the end of November, for April feeding. Thereafter December-sown swedes come in. The sowing of any of these may be postponed for a month in suitable localities, so as to throw the feeding later. One acre of a fair crop of turnips should carry from forty to fifty lambs for two months, or older sheep in proportion.

A difficulty presents itself in providing for sheep about midwinter where hard turnips and swedes do not do well, or where partial failures in this crop occur. Mangolds are a crop which are invaluable for the sheep-farmer as for the dairy-farmer. A small area, well manured and cultivated and properly cleaned and singled in the early stages, will support probably three times the stock which a similar area in turnips would carry. But for sheep stock, and especially for hoggets, mangolds must be mature, which means that they cannot judiciously be fed before August. Buda kale and Thousand-head kale sown early in January, if circumstances are propitious and the winter is not too

severe, throw a considerable amount of secondary feed in July of a kind suitable for all classes of sheep, and these crops, along with autumn-sown cereals, may be used to carry stock on after the earlier roots are consumed.

It is doubtful if cereal green-feed for sheep is profitable, except in the special connection of supplying a deficiency when in the absence of swedes there is not much else available in the paddocks. The carrying-capacity of cereal forages has been carefully studied at the Central Development Farm. For short-period grazing—say, up to six months—there is not much difference in the production under grazing treatment of the different cereals. They average under ordinary conditions about six grown sheep per acre for the six months. With a late sowing (30th April) and very adverse growth conditions, this last winter they averaged at Weraroa no more than four sheep per acre for the six months. This, however, was on rather poor shingly land. Probably the heaviest July-August stocking under most conditions would be permitted by Dun oats sown in March. Cape and other barleys, although widely grown for feed, have not shown to advantage in these trials, being surpassed after the very early stages, both in the amount and frequency of stocking afforded, by oats on the free land and by wheat on the heavier ground.

TRACTOR EXPERIENCE AT WERAROA.

In September of last year a small 8–16 horse-power Avery tractor was purchased by the Department for the Central Development Farm, Weraroa. The Farm Manager reports that the tractor has rendered satisfactory service, being convenient for stationary work as well as for work on the land. From 8th October, 1917, to 31st July, 1918, the area ploughed by the tractor was 235 acres. The average rate of ploughing was slightly over 3 acres per day, including time taken up in attention to tractor, shifting from paddock to paddock, and delays occasioned by remains of stumps and stones. In good fair-sized free paddocks a ploughing-rate of 5½ acres per eight-hours day was achieved. On a steady run for twenty-six days the area ploughed was 101 acres for an average consumption of 1½ gallons of "Powerin" per acre. Tractor and plough have been operated throughout by one man. The general average consumption of Powerin in ploughing was 1¾ gallons per acre. No land work other than ploughing was performed by the tractor, as it was considered that other cultivation could be more effectively done by team work in the relatively small paddocks under cultivation, the average being 15 acres. In addition to land work the following stationary work was performed by the tractor during the same period: Crushing feed (seconds of wheat, barley, oats, and peas), 9 days; chaff-cutting, 19 days; threshing cereals, 15 days; ensilage-cutting, 3½ days; wood-cutting, 4 days. At certain periods the tractor was not working, the operator being engaged on team or other work. The cost of repairs during the year was £28.

NOTES ON SOME POVERTY BAY SOILS.

By B. C. ASTON, F.I.C., Chemist to the Department.

WHATEVER may have been the circumstances which caused Cook in 1769 to apply the name " Poverty Bay " to the fertile district of which Gisborne is the chief town, the present injustice of the name is so obvious to all that it is perhaps sufficient reason for making no change in a name which not only has lost its original significance, but has become when attached to that of the products of the district a testimonial to their excellence.

In 1907 (see page 21 of the Department's 1907 annual report) the writer analysed some soils from the Willows Estate (of Mr. F. Hall) and the adjacent Matawhero property (of Mr. John Allen). These samples had been taken in accordance with directions of the Chemist by the Inspector stationed at Gisborne, for the express purpose of determining the amount of mineral plant-food, which was suspected by the writer of being extraordinarily high. On analysis this proved to be the case. The samples yielded 0·034 to 0·054 per cent. of available phosphoric acid, while the subsoil was also rich in this nutrient; the available potash was 0·023 to 0·043 per cent., and the total nitrogen 0·3 per cent.

In April of this year the writer, having previously asked the organizing secretary of the Gisborne Farmers' Union (Mr. T. H. Bedford) to consult with representative farmers and select typical areas, visited these selected areas and obtained fair samples of the different types of soil situated within easy access of the Town of Gisborne. That the district is subject to severe floods was prominently brought to one's notice, a previous attempt to examine the district in March having been frustrated owing to the country being temporarily submerged by the flood-waters of the Waipaoa River. During the April visit it also rained heavily, resulting in the washing-away of bridges and the flooding of a considerable part of the country inspected. The conditions were therefore ideal for seeing the forces at work which the settlers have to cope with, although scarcely compatible with the comfort of the soil-explorer. One learnt that the flooding of the country results in the deposition of large quantities of river silt derived from soft rocks containing carbonate of lime, and which also appear to contain comparatively large quantities of the mineral plant-foods, phosphoric acid and potash, in an available condition—*i.e.*, soluble in 1-per-cent. citric-acid solution. Thus a sample of silt deposited by the flood in large quantities on flat land growing maize contained 2·32 per cent. of carbonate of lime, 0·07 per cent. of phosphoric acid, and 0·2 per cent. of potash soluble in hydrochloric acid, and 0·034 per per cent. of potash and 0·013 per cent. of phosphoric acid soluble in 1-per-cent. citric acid. Neglecting the potash and phosphoric acid as probably being present in similar quantities in the soil which is being covered up, and assuming that the soil requires lime, by the flooding of the land and by the subsequent deposition of 6 in. of silt similar to that analysed 10½ tons of carbonate of lime per acre would be

deposited, to buy which would cost at least £10. If the flooding of the river could be controlled and the composition of the silt brought down is found to be fairly uniform (which must not be taken as a matter of course), there may be possible a method of soil-improvement analogous to the method known in England as "warping" or "colmetage," practised in older countries, particularly on lands adjacent to the Humber and Ouse situated near tidal estuaries and below the water-level at high tide. Here the lands are paddocked off by means of embankments, and the flood-waters allowed to deposit the suspended silt from time to time until from 1 ft. to 3 ft. of silt is deposited on the land. Hall speaks of warp soils as being as a rule fertile and noted for producing seed-corn of high quality. They are to all intents and purposes artificial alluvial soils composed entirely of the finer sands and silts without much clay material, and are comparatively rich in organic

EFFECT OF MARCH-APRIL, 1918, FLOODS AT ORMOND, POVERTY BAY.

Showing deposit of rich silt (analysis K 49 in table), damaged fences, and maize crop. [*B. C. Aston, photo.*

debris and other plant-food, except perhaps potash. The fertilizing of the Egyptian lands by the red flood-waters of the Nile containing lime and phosphates from the Abyssinian Mountains is an instance more to the point.

From the analysis of the Ormond silt (K/49 in the accompanying table) it will be seen that it is composed of fine sand and silt, but contains no coarse sand or clay. It effervesces freely with dilute hydrochloric acid, and is comparatively rich in all plant-food. Another method of improvement is suggested by the remarkable fact that the subsoil in two of the soils contains a much larger percentage of carbonate of lime than is found in the surface soil. A method of cultivation which would bring the subsoil nearer the surface might be expected to produce an improvement in those cases in which the top soil is shown by

experiment to require lime. In growing lucerne and lime-demanding crops, where the roots are able to penetrate to the subsoil layer this great difference in the composition of the soil and subsoil is of significance and is worthy of further investigation.

The soils of the Gisborne flats, until further investigation shall have confirmed the results of the flying preliminary visit made in search of samples, may be tentatively classified as follows. The classes are arranged in the ascending order of their chemical richness, and it will be interesting to know whether this coincides with the farmers' idea of their fertility. The key numbers given refer to the accompanying table of analyses.

Coarse Sandy Soils.—These are represented by consolidated dune-sands at Awapuni—K/37, 38 (K/38 is subsoil). They no doubt have a littoral origin, having been blown in from the coast. They are characterized by containing over 60 per cent. of coarse sand, and have the greatest "lime-requirement" figure of any soil collected in the district; they are also the poorest in mineral plant-food. In contradistinction to the dune-sands of the west coast of the North Island the amount of calcium compounds soluble in hydrochloric acid is small. Fortunately, the area of these poor sandy soils in the Gisborne district is small compared with the great extent of fertile country beyond them.

The vegetation of these soils, which consist of 5 in. of black soil on sand (never ploughed), is a sward of ratstail grass (*Sporobolus*), alfilaria, and sorrel, while prairie-grass and Bathurst burr (a noxious weed) were also present. The natural flora before improvement was *Scirpus nodosus*, *Discaria*, *Pomaderris phylicaefolia*, and bracken (*Pteris esculenta*).

Pumice Soils.—K/42, 43, 46, 47, 48 (K/43, 48, are subsoils). These soils are characterized by containing much coarse sand and a little gravel, the particles consisting of water-borne pumice, an acidic volcanic rock utterly different in all respects from the river sediments and blown sands which occur in the same district. The outstanding chemical character of the Gisborne pumice compared with the other fertile soils of the district is the low amount of available phosphoric acid, total calcium (lime), and magnesium compounds soluble in hydrochloric acid. In accordance with the results of chemical analysis it is interesting to note that the owner has found it necessary to manure year after year the 90-acre pumice paddock from which K/46 was taken. This area has been cultivated for oats, which have been grown for at least six years in succession. Compare this with the statement of the owner of K/34 silt paddock, representative of his holding of 200 acres, which has never been manured and will winter five ewes to the acre or grow maize well—a 50-bushel crop of which will remove from the soil 75 lb. of nitrogen, 50 lb. of potash, and 30 lb. of phosphoric acid per acre. It is difficult to say what was the original vegetation of these pumice soils (in colour black, with plant-remains), but in K/47, a virgin paddock near K/43 soil, there was a strong growth of bracken-fern (*Pteris esculenta*).

Sandy Silts and Fine Sandy Loams.—Examples K/39, 40, 41, 44, 45 (K/41, 45, are subsoils). These are river sediments being laid down in terraces adjacent to the River Waipaoa. They contain varying proportions of different-sized particles, but the fine-sand fraction is

Laboratory No.	Locality.	Description.	Loss on Air-drying (Moisture).	Loss at 100° C. (Moisture).	Loss on Ignition. (Organic Matter and Water of Combination).	Total Nitrogen.	"Available" Mineral Plant-food. 1-per-Cent. Citric-acid Extract.		"Total" Mineral Plant-food. Hydrochloric-acid Extract.				"Lime-requirement." Tons Calcium Carbonate ($CaCO_3$) per Acre.	Mechanical Analysis.					
							Potash (K_2O).	Phosphoric Acid (P_2O_5).	Potash (K_2O).	Phosphoric Acid (P_2O_5).	Lime (CaO).	Magnesia (MgO).		Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Moisture, &c.
K/34	Te Arai Valley, Oweta, Blk. V, Turanganui S.D.	Silt ..	17·33	19·02	4·56	0·353	0·032	0·036	0·22	0·15	1·33	1·06	0·2	..	0·4	7·3	35·5	26·6	27·6
K/35	Makauri, Block XIV, Waimata S.D.	Silt ..	15·33	24·00	13·30	0·579	0·034	0·080	0·28	0·30	1·26	0·80	1·0	..	4·5	7·3	34·4	16·1	25·4
K/36	Ditto	Silt ..	22·64	21·78	11·02	0·420	0·023	0·019	0·20	0·18	1·06	0·79	1·2	..	4·5	11·6	31·8	18·1	31·5
K/37	Awapuni or Waikanae, Block II, Turanganui S.D.	Coarse sand	8·81	15·82	7·05	0·159	0·025	0·007	0·23	0·06	0·33	0·26	1·8	3·5	60·5	8·9	3·4	..	23·1
K/38	Ditto (subsoil of K/37) ..	Coarse sand	15·39	14·02	3·95	0·091	0·017	0·005	0·22	0·05	0·21	0·22	1·2	1·7	73·8	4·4	1·7	..	18·5
K/39	Whakawhetera, Block V, Turanganui S.D.	Sandy silt ..	18·07	14·56	8·84	0·303	0·039	0·022	0·23	0·12	1·07	0·66	1·0	..	2·1	27·3	25·1	18·9	24·6
K/40	Point paddocks, Turanganui S.D.	Sandy silt ..	11·11	18·78	7·61	0·235	0·030	0·014	0·27	0·09	0·87	0·77	0·4	..	0·9	26·9	26·4	15·9	28·0
K/41*	Ditto (subsoil of K/40) ..	Fine sandy loam	Nil	13·64	3·73	0·078	0·021	0·017	0·19	0·07	1·66	0·66	Nil	..	17·6	41·4	13·6	6·8	19·9
K/42	Section 38, Block IV, Waikohu S.D.	Sandy pumice loam	14·93	24·04	11·32	0·309	0·025	0·008	0·21	0·10	0·34	0·20	1·0	0·9	34·6	15·5	13·1	3·9	33·8
K/43	Ditto (subsoil of K/42) ..	Ditto ..	Nil	15·18	4·75	0·096	0·020	0·003	0·26	0·05	0·23	0·17	0·8	2·1	32·7	22·3	14·9	6·1	21·2
K/44†	Poha, near headlands, Sec. 16, Blk. IV, Waikohu S.D.	Fine sandy loam	20·00	10·04	7·14	0·221	0·030	0·027	0·23	0·10	0·66	0·72	Nil	..	1·4	39·1	27·1	11·1	19·7
K/45‡	Ditto (subsoil of K/44) ..	Ditto ..	6·40	12·80	6·17	0·116	0·029	0·020	0·20	0·09	2·05	0·78	Nil	..	2·7	36·5	25·5	12·5	21·9
K/46	Waihirere, Waipaoa River ..	Pumice sandy loam	8·79	26·76	10·00	0·257	0·024	0·005	0·19	0·09	0·38	0·12	0·8	4·5	30·2	14·8	13·2	3·1	34·5
K/47	Ditto (virgin)	Pumice coarse sand	8·57	24·16	9·48	0·254	0·023	0·009	0·20	0·08	0·39	0·16	0·8	6·9	48·4	7·6	5·3	..	31·8
K/48	Ditto (subsoil of K/47) ..	Ditto ..	9·99	19·24	5·20	0·053	0·023	0·004	0·18	0·06	0·42	0·24	0·2	8·2	40·6	13·7	8·8	1·6	25·5
K/49§	River silt, Ormond, Block VIII, Waimata S.D., Waimaire Settlement	Fine sand ..	6·25	11·24	3·37	0·053	0·034	0·013	0·26	0·07	2·00	0·79	Nil	..	6·0	53·8	16·6	2·1	19·9

The results, except those in the first two columns, and those of the mechanical analysis, are calculated on the sample dried at 100° C. All results are percentages.

* Exhibits pronounced effervescence with hydrochloric acid. Contains 1·50 per cent. carbonate of lime. † Exhibits slight effervescence with hydrochloric acid. Contains 0·58 per cent. carbonate of lime. ‡ Exhibits pronounced effervescence with hydrochloric acid. Contains 1·85 per cent. carbonate of lime. § Exhibits pronounced effervescence with hydrochloric acid. Contains 2·32 per cent. carbonate of lime.

always greatest in quantity. Chemically these soils are rich in available and total mineral plant-food, being only excelled in this respect by the silts—the richest soils of the district. It will be remarked that K/39, the sandiest soil under this heading, has a "lime-requirement" of 1 ton of carbonate of lime per acre, whereas number K/40 requires only 0·4 ton; the calcareous subsoil of K/40, of course, shows a "nil" requirement.

Silts.—K/34, 35, 36. These are the richest soils of the Gisborne flats, being composed of silt and fine silt, and are characterized chemically by having an extremely high percentage of available phosphoric acid, while the total and available potash, total phosphoric acid, lime, and magnesia are also high. K/35, a black soil, which may be taken as the richest of these, was sampled from a strong grass (chiefly rye-grass) paddock which had been down twelve years. K/36 was a yellower soil in the same paddock.

CONCLUSIONS.

Of much interest to the student of soils are the Poverty Bay flats near Gisborne. They for the larger part show every chemical indication of great natural fertility. There is evidence to show that the occasional inundation of the countryside by the flooding of the Waipaoa River is by no means an unmixed evil, owing to the richness of the silt deposited, especially in carbonate of lime. As the uncertain nature of the New Zealand climate would suggest, and contrary to the classic instance of the Nile, there appears to be no periodicity in the occurrence of the flooding, which may happen in any month. The irregularity of the recurrence of these floods would seem to argue that the waters should be controlled, even although the result of flooding at times may be beneficial.

Apart from interest to the local settler, these analyses may serve as an object-lesson to those in less favoured districts by showing something of the chemical composition of soils of admittedly high fertility and the benefit arising from the presence of carbonate of lime in the soil. This tends to keep the phosphates in an available condition and render further application of phosphates unnecessary.

The "lime-requirement" figure by the Hutchinson-MacLennan method has been determined in each soil, and it will be noted that some soils show little or no necessity for liming. All of those which show the presence of calcium carbonate give a "nil" return by this method. It is an interesting fact that in the mechanical analyses in no soil was any quantity of clay fraction found. The whole of the soils of this area are possibly composed of river silts and coarser particles.

Finally, it may be pointed out that this article is written in a suggestive spirit with the idea of stimulating further investigation of a remarkable district.

In considering the table of analyses on the previous page the farmer should be warned that the terms under the heading "Description" are used in a strictly technical sense and connote soils the composition of which varies within definite limits as laid down by the United States Bureau of Soils classification. The soils analysed were all taken with a spade to a uniform depth of 9 in., and the subsoils were taken to the same depth below.

ENSILAGE.

(Concluded.)

By W. DIBBLE, Assistant Agriculturist.

THE SILO SYSTEM.

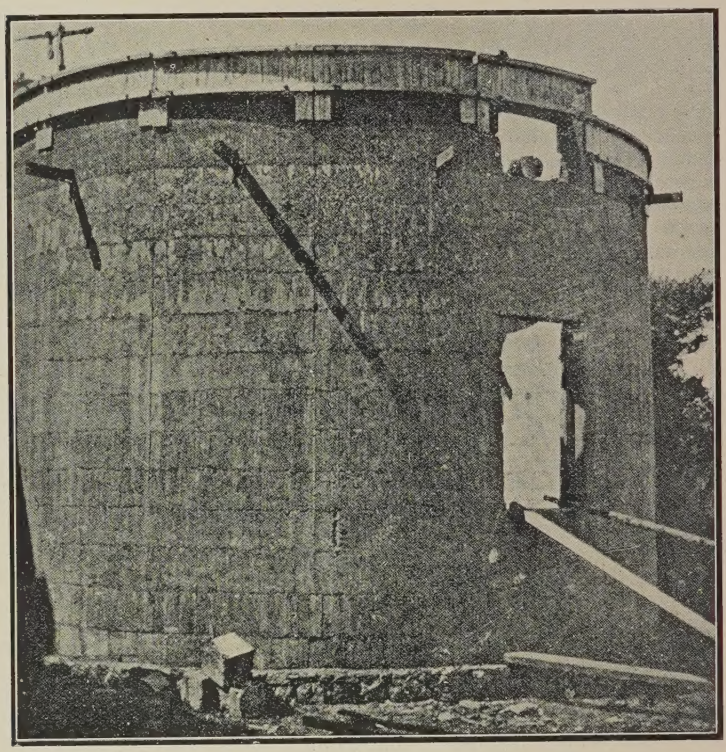
SPECIALLY constructed silos for ensilage are as yet few and far between in New Zealand, but with the continued development of the dairy industry on high-priced land this system will, doubtless, before long take its place on many of our dairy farms, in conjunction with specially grown and carefully siloed crops. There are many different designs of silos, constructed in various materials, such as wood, concrete, brick, or steel. For all-round suitability in New Zealand, however (especially under present conditions), the circular concrete silo may receive first recommendation. It should be noted that with a square-walled silo the material does not settle properly in the corners, with the result that the air gets in and a portion of the silage becomes spoilt.

CONSTRUCTION OF CONCRETE SILO.

For a herd of forty to fifty cows a silo 12 ft. in diameter and 20 ft. in height is of sufficient dimension. The concrete silo should be built, of either plain or reinforced, in the proportion of one part of cement to five of gravel. If of plain concrete the wall should be 7 in. or 8 in. thick, and if reinforced 5 in., built on a good foundation 10 in. thick, which should be made by excavating to a depth of 2 ft. and filling up again with loose stones mixed with cement. The mould should be in two sections of about 5 ft. in length and 26 in. deep—4 in. for a grip on the wall, 18 in. for concrete, and 4 in. for the bolts to stand clear at the top. The sections may be made of 1 in. tongued-and-grooved timber, nailed to pieces of 3 in. by 3 in. cut to the required segment of the circumference of the silo, and should be held together by ½ in. round bolts with square heads, provided with washers to prevent the heads and nuts from sinking into the wood. The lower bolts should be kept well greased, and be pointed to permit of their being punched out without injury to the thread. These bolts should be withdrawn the day after filling the mould, which can then be moved from time to time—about every four or five days—as the wall is built. Doorways, 3 ft. by 2 ft. 6 in., for filling and emptying the silo, should be set out at equal distances apart. The doors for these can be made airproof by placing a sheet of plain iron on the inside, and bolting them through to the outside of the silo through a 2 in. by ½ in. iron frame embedded in the outer part of the concrete wall. The roof may be made octagonal, roofed with iron or other suitable material, and sitting on the wall of the silo. Provision should be made to permit of one-fourth of the roof being removed in order to facilitate filling the silo to its full capacity.

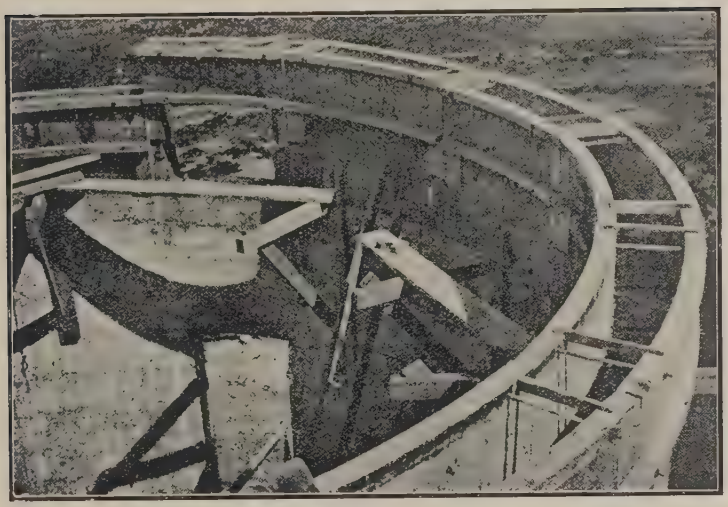
MAKING THE SILAGE.

Material chaffed for silage should be cut in ½ in. lengths and elevated into the silo by means of a cutter and blower. If the material is suitable for siloing without being cut it can be elevated by means of a derrick and deposited in the silo through the opening in the roof made by the removable section. The first day's cutting should be distributed evenly around the silo and left undisturbed until it registers a temperature of 160° F. It should then be levelled and well tramped

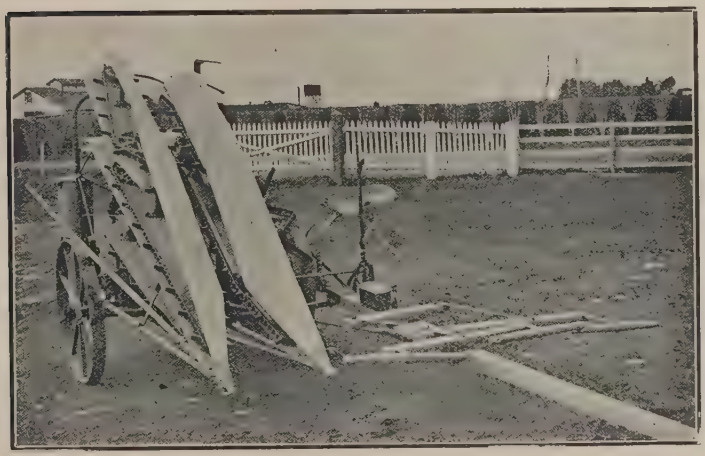


CONCRETE ENSILAGE SILO UNDER CONSTRUCTION.

at the sides in order to provide an even temperature for the next layer. From 2 ft. to 3 ft. of material should be added each day until the silo is filled, care being taken to maintain a temperature of from 125° to 130° at a depth of 3 ft. below the surface. Mould will develop if the material is allowed to heat nearer the top, but a tendency in this direction can be checked by adding more material without delay. The temperature may be ascertained by using a pipe and thermometer in the same way as described for stack ensilage. The pipe need not be kept in the material continuously; it may be inserted after each day's



UPPER VIEW OF WOODEN MOULDS ON SILO WALL.



A USEFUL HARVESTING IMPLEMENT FOR ENSILAGE-MAIZE: THE AMERICAN "CORN"-BINDER.

(Photographed at the Central Development Farm, Weraroa.)

filling, and the temperature read the following morning. If it does not register from 125° to 130° wait for a day, or even two days, before adding fresh material, otherwise the silage will be sour, and this, though wholesome, is not as satisfactory as well-cured sweet ensilage. After the silo has been filled, or all the material has been used, a tarpaulin or strong black paper should be spread over the surface and covered with chaff or cavings to a depth of 12 in. to 14 in. The covering-material should then be moistened with water to encourage the growth of mould. This will exclude air and light.

PIPE AND THERMOMETER FOR TAKING TEMPERATURE OF ENSILAGE IN THE MAKING.

FEEDING OUT.

When emptying the silo the silage must be taken from the top, not the bottom. For feeding to the stock a layer of about 2 in. should be taken off evenly, morning and evening. If the silage is of chaffed material it may be fed in boxes or troughs; and, if not, it may be distributed over the paddock the same as stack ensilage. A cubic foot of chaffed silage should weigh about 40 lb., which would be sufficient for a day's ration for the average cow (20 lb. morning and evening) in addition to what grazing she may obtain in the fields.

HUMBLE-BEES AND BROAD BEANS.

REFERRING to the commonly accepted view that the frequent non-setting of broad beans, especially early in the season, is due to the action of humble-bees in perforating the base of the flowers, Mr. Isaac Hopkins writes,—

"I think there is much misunderstanding with regard to this matter. So far as I have been able to gather from some of the best works on the fertilization of flowers, the actual perforation of the corolla by insects to obtain the nectar, which they find a much easier process than delving into the blossom from above, does not actually prevent cross-fertilization. Should the blossoms be visited by insects for the nectar in a legitimate manner fruit will result whether the corolla be perforated or not. I am not altogether convinced that humble-bees are alone responsible for the perforations in bean-flowers. I have watched very closely and found the blossoms punctured when not a humble-bee has been seen about, and even before the blossoms were fully open. The early-grown beans seem to fail most with me; the later-grown plants yield fairly well if the rust is kept down. On inquiring of a leading horticulturist why so many of the first bean-flowers on the plants failed to produce fruit, he attributed it to the strong growth of the plants drawing the sap or strength away from the flowers; when the growth moderates fruit is likely to follow. The topping is done to check the growth and throw the strength into the blossoms. He does not condemn the humble-bees."

THE PIG POSITION IN NEW ZEALAND.

By the Live-stock Division.

UNDER good management the pig is one of the most profitable of farm animals, and viewed in this light the latest statistics regarding the number of pigs in New Zealand give food for thought. At 31st January, 1917, our pigs numbered 283,770, while for the same date in 1918 the number is given as 258,269, a reduction of 25,501.

This is probably to be accounted for by dairy-farmers, as a result of the good values of steer calves, having utilized their skim-milk and whey for feeding more calves and fewer pigs, and also owing to the high cost of other food material suitable for pig-feeding. A further deterrent to extensive pig-breeding lies in the fact that the volume of dairy-factory by-products available for providing pig-food has been largely reduced in quantity and quality as a result of the manufacture or dried milk, casein, and milk-sugar, the last two being wholly manufactured from the by-products.

The result of all this is now apparent in a distinct shortage of pigs in the Dominion; and, seeing that the pig is such a profitable animal to the farmer, it is a matter for very great regret that this shortage should exist. It is only quite recently that the food-shortage in Great Britain was greatly alleviated by the purchase by the Imperial Government of immense quantities of bacon from the United States. This affords a valuable object-lesson to the New Zealand farmer, seeing that his fellow-farmers in the States, under present conditions, have probably to pay for concentrated pig-foods prices averaging as high as those ruling here. Many of them, probably the majority, have not dairy-factory by-products available as their principal source of food material. No doubt, as the result of circumstances, the Imperial Government paid a good price for the bacon, but notwithstanding this the plain object-lesson remains.

A small area of land cultivated for the special purpose of providing food for pigs can be made to pay handsomely at the cost of comparatively little labour and small additional expense. Some preliminary experiments were recently carried out at the Central Development Farm, Weraroa, on the lines of showing the value of the practice of growing cheap pig-feed for breeding-sows and growing store pigs on small areas. Data of some of these tests are given in the present issue of the *Journal*, and it would be well worth while for farmers to follow up the principles which are embodied in the results.

It is not suggested that the principle of rearing more dairy-farm-bred steer calves of suitable type at the expense of feeding fewer pigs is a wrong one, but the point for consideration is whether with improved methods a proper supply of pigs cannot be maintained without reducing the number of calves reared for beef-production purposes. It is capable of being done, and though involving more labour it would result in increased profit. It could well be argued that the case of the bacon-supply to the United Kingdom, as referred

to, is not applicable to New Zealand, seeing that shipping-space for any surplus might not be obtainable for us in the near future. But the position here at the present time is that we are hardly able to meet our own internal requirements, a state of affairs which should not exist in so productive a country as this, so long as the necessary labour is obtainable.

The subject will be followed up in the *Journal* from time to time, and any farmer wishing to obtain information on special points connected with growing forage crops for pigs or pig-breeding and pig-feeding generally is also free to write to the Department, when the best available advice will be sent.

SOME POINTS ON PORK-PRODUCTION.

By J. BROWN, B.Sc., N.D.A., Central Development Farm, Weraroa.

THE relative scarcity of pigs of all classes and the high prices now being realized for pork and bacon call for some consideration of the subject of pigs on the dairy farm. The system widely followed of maintaining brood sows on whey and rough grazing with odds and ends of roots when available, and of carrying on progeny in slow progression from the weaner stage on whey with a minimum of pollard, sucrosine, or other meal, cannot be considered satisfactory. The usual life of the sow under such treatment is unprofitably curtailed, and successive litters tend to become more and more puny and ill-nourished. Two points require special consideration: (1) Better maintenance for the sows; (2) more rapid progress of weaners to the pork or bacon stage.

So far as the carrying of the sows is concerned, the main improvement should be in the direction of replacing casual foraging by crops systematically grown and grazed. Lucerne, red clover, rape, mangolds, artichokes, and pumpkins can be grown and utilized to provide bulky feed for sows throughout the year. If these crops are supplemented by a small area of field-peas harvested and stacked near the grazing or feed pens and forked over as required, the best results may be expected. In most of the dairying districts of the North Island cob-maize is also successfully grown, and the feeding of maize on the cob as an alternative to (or better in conjunction with) peas affords an easy and economical method for the successful maintenance of sows in good breeding-condition.

It is estimated that for the four months August to November inclusive 1 acre of well-grown mangolds, with an allowance of peas on haulm, or cob-maize, equal to 1 lb. grain per head per day, and some soaked lucerne or clover chaff, will maintain from fifteen to twenty sows. During the summer, by sectional pasturing on lucerne, red clover, and rape, 2 to 3 acres with whey supplied *ad libitum* will sustain the same number of sows for five months; while 2 acres of pumpkins and artichokes will see the breeding-herd through the rest of the year. To provide grain, peas, or maize for supplementary concentrated feeding from 2 to 3 acres should be planted.

Such a system of cropping and feeding for brood sows may be relied on to give good results; and here it may be pointed out that there is a prevailing misconception that a poor condition of the sow is most favourable for conception and large litters. Distinction must be made between an overfat condition and good-breeding condition. The proper type of sow will put on condition rapidly under proper treatment after weaning, and will milk it off again after farrowing, to the unquestionable advantage of her litters.

With regard to the raising of market pigs, it has been pointed out that unsatisfactory results are frequently attributable to two factors: (1) Lack of robustness of the young pigs at weaning, due to an impoverished condition of the dam; (2) a prolonged store period of slow increase due to illiberal supplies of whey and scant measure of any solid food. The first obstacle may be removed by a cropping-system planned for the needs of the sows as just described. In the carrying forward of weaner pigs it is always a point of departure in opinion whether rapid progress towards market weights should be aimed at, or whether a definite store period, during which the animal grows without developing much condition, should be observed. In these days of high-priced purchased foods the tendency is to feed concentrates very sparingly, thus prolonging the growing and finishing processes. That this is false economy is readily realized from a consideration of the respective parts played by food in maintenance and fattening. It takes about 2 lb. of pollard or similar foodstuff per day to maintain the weight of a 100 lb. pig. Any food supplied above this amount makes for increase. If this "food for increase" is supplied in quantity less than the pig will consume the time required to reach a given weight must be proportionately lengthened, at the cost of so much more expenditure on the maintenance requirement. A difference of even one month in the time taken to bring a pig to a marketable weight may mean a difference of 6s. to 8s. in cost of production in favour of the rapidly finished pig.

Obviously, if any prolonged store period is observed it must be effected largely by utilizing cheap home-grown foodstuff. Even in this connection the following data from observations made at the Central Development Farm are interesting and instructive.

In March, 1918, seven pigs, aggregating 488 lb. fasted live-weight, were pastured on red clover, with an allowance of 1½ lb. wheat seconds per head per day, pollard being unprocurable at the time. The gain in fifteen days was 20 lb. The area of red clover was ¼ acre. Another lot of seven pigs, aggregating 472 lb. live-weight, were pastured on ¼ acre of red clover, with an allowance of 1½ gallons per head per day of separated milk. The gain in fifteen days was 46 lb. At the same time two lots of seven pigs each, aggregating respectively 515 lb. and 536 lb., were pastured on two ¼-acre sections of ripe peas. The total gains in fifteen days were respectively 92½ lb. and 84 lb.

These figures clearly bear out the argument for *ad libitum* feeding of grain or meal for reducing maintenance costs. The profitability of ordinary field-peas as a fattening-crop for pigs grazed on them is also established by the final results. The ½-acre section carried fourteen pigs for one month, during which they put up a total increase of 296½ lb., equal to 593 lb. per acre. It may be added that the crop

was grown on stony ground and experienced very dry weather during the growing-period. At current prices for pork this must be regarded as a very satisfactory return.

The practice of growing an area of field-peas and maize for topping off market pigs can be commended to all interested. The labour involved is inconsiderable. No whey was fed in the foregoing trials, but the writer is of opinion that the highest returns for whey fed to pigs are realized when it is given in conjunction with a ration of peas.

MUSTARD FOR GREEN MANURE IN GLASSHOUSES.

THE periodical renovation of soil in glasshouses devoted to crops such as tomatoes is a matter on which considerable diversity of opinion and practice obtains. While some growers remove the soil each year, others follow systems of green-manuring. For the latter purpose leguminous crops such as peas, beans, crimson clover, &c., are more usually grown. A less-known crop which is now finding favour with several growers is mustard. In forwarding the accompanying photo

CROP OF MUSTARD IN MR. LUNT'S GLASSHOUSE.

of a crop of mustard in his glasshouse Mr. E. Lunt, of Addington, Christchurch, states that after trying a variety of green-manuring crops he considers mustard to be the best, as it is a sure crop each year. He finds tomatoes do well after it, his present crop being the ninth without removing the soil, and each crop has been a success. This experience is useful as indicating that soil-removal is unnecessary under ordinary conditions in the glasshouse.

THE NEW ZEALAND FLAX-GRUB.

PROGRESS OF THE INVESTIGATION.

By DAVID MILLER, Entomologist.

THE results of the flax-grub (*Xanthorhoe praefectata*) investigation up to the present show that the well-being of this insect is dependent firstly upon an abundance of its natural food—New Zealand flax (*Phormium tenax*), suitable diurnal sheltering-places for the grub, and comparatively dry soil conditions, and secondly upon the effect of natural insect enemies.

Under normal conditions the insect is to be found at its best among flax growing in comparatively dry situations, where are generally considerable numbers of dead and dry flax-leaves, which, since they are curled up longitudinally in the form of elongate tubes, are excellent shelters for the grubs during the day, the latter being nocturnal in their habits, and avoiding the light. Observations have generally shown that greater accumulations of dead leaves are to be found in dry localities than in flax areas kept continually moist, a factor, combined with the soil conditions, of considerable importance to the life-cycle of the flax-grub. In a typical virgin swamp—as the Makerua (in the Manawatu district) formerly was—the flax is to be found scattered and of stunted growth, the food-supply and sodden soil in consequence being extremely unfavourable for an abnormal increase of the grub. On such natural swamp conditions, unfavourable to the grub, being suddenly changed by overdraining, there resulted a dense and luxuriant growth of flax upon a comparatively dry soil, so that the insect, finding an unlimited food-supply and suitable soil and shelter conditions, increased with abnormal rapidity and caused extensive damage to the flax-leaf.

The Makerua area shows not only the results of overdraining and consequent abnormal grub-activity, but also the effect of a constant soil-humidity upon the prolificness of the pest. The topographical features of this area have already been discussed in detail in a former article (*Journal*, July, 1917), in which it was shown that, owing to the height of the Manawatu River banks north of Tokomaru and to the river bounding only the west side of this part, river-inundation is comparatively rare and the grub-attack is most severe. Furthermore, south of Tokomaru, where the damage to the leaf is not severe, not only does the river flow between less-defined banks (particularly around the Moutoa area), but also this part of the Makerua—that is, south of Tokomaru—is bordered on the west and south by the Manawatu River and on the east by a tributary (the Tokomaru Stream) which readily overflows when banked up by a rise in the main river. These features, together with the fact that the Manawatu River banks are elevated above the level of the surrounding swamp areas, are responsible for frequent inundations in times of flood and the more or less permanent soil-humidity. This higher percentage of soil-moisture in the Moutoa and southern parts of the Makerua areas was illustrated at the time of the drought

during the summer of 1916-17, when the pasture of these areas was not influenced, while that of the surrounding areas not moistened by the Manawatu River was dried up.

LIFE-HISTORY OF THE FLAX-MOTH.

Xanthorhoe praefectata, an indigenous New Zealand moth, has a distribution throughout the North and South Islands and Stewart Island—indeed, wherever its food plant, *Phormium tenax*, is to be found—and occurs not only at sea-level but also at an elevation of 4,500 ft., where its larvæ feed upon the mountain-flax (*P. Cookianum*). It is not yet known whether the insect is to be found at Norfolk Island, or at the Chatham and Auckland Islands, where *P. tenax* exists. The moth, which is nocturnal in its habits, is pure-white in colour, the wings, however, being minutely dotted with grey and ornamented with several rows of indistinct lines near the margin. When at rest upon a flax-leaf the wings are spread out, rendering the insect very conspicuous against the green flax, although the moth resembles to a great extent the white flakes of dried gum exuded by this plant. In the daytime the insect is to be found sheltering amongst the denser foliage of the flax.

The eggs are more or less globular in form, but flattened dorsiventrally. When first deposited they are green in colour and closely resemble the leaf upon which they are placed, but within thirty-six hours, at an average temperature of 65° F., the original colour gives place to a reddish tinge, which in five days from oviposition turns to a rich red, due to the red dorsal stripe of the developing larvæ, rendering the eggs very conspicuous. The eggs are deposited in batches of from one to ninety or more, a single female producing on an average two hundred eggs.

When the larvæ hatch they are transparent yellow with a central dark-red stripe and a large head, and measure about $\frac{1}{15}$ in. in length. On emerging they at once attack the lower epidermis of the flax-leaf between the rows of fibres, leaving very narrow and indistinct cuts; after the first meal, and owing to the nature of the food, the colour of the young larvæ becomes a bright green, which predominates for about seven days, until the permanent rich-red stripes and yellowish ground colour of the grubs become opaque and consequently conspicuous.

As the larvæ grow they moult several times, and cease feeding for a few days prior to this process. Since the cuts on the leaf increase correspondingly in length and width with the age and size of the grubs, it is possible, by examining the damaged leaf and judging from the size and freshness of the cuts, to tell the approximate age of the larvæ at work. In the daytime they shelter in the dead and dry flax-leaves abundant in most comparatively dry areas; shortly after nightfall the larvæ appear and commence feeding.

When full-grown—that is, when about $\frac{3}{4}$ in. in length—the grubs become sluggish and enter the soil, where, at a depth of about 2 in. or less, they will surround themselves with an earthen covering in which the last moult occurs, the cast skin serving to block the only opening to the cocoon. At this period, contraction from both ends taking place and a pinkish colour developing, the larvæ transform into the pupæ, from which emerge the moths of the following brood.

SEASONAL LIFE-CYCLE.

The seasonal history of the flax-moth shows a considerable overlapping of broods. Generally speaking, there is a main generation overlapped by a smaller one, both of which are two-brooded. The main brood of moths appears by the end of October, but disappears by the end of December, and the resultant larvæ, reaching their maximum of damage in January, have for the most part pupated by the end of this month. The moths from these pupæ appearing during March until well into May give rise to the overwintering brood of larvæ, which do most damage the following August and September, pupation again taking place at this period until the November brood of moths reappear. In the case of the overlapping generation moth-emergence commences during August, reaching the maximum in September and October. Their larvæ are active between the end of August and beginning of December, the greatest amount of damage by them occurring during October to end of November. Pupation takes place between November and March, the second moth-brood appearing during the middle of February, March, and beginning of April. The larvæ of this brood are active from the latter part of February to the latter part of June, doing most damage during April and May. Pupation commences by the end of May, this generation hibernating as pupæ and the moths reappearing during August. This seasonal life-cycle is subject to certain modifications due to climatic conditions.

It will be seen from the accompanying graph illustrating the seasonal life-cycle that the overwintering larval brood of the main generation is of longer duration than the summer brood, due to the climatic conditions, the higher summer temperature accelerating and the lower winter temperature, combined with a greater rainfall, retarding the development of the larvæ. On the other hand, the larval broods of the overlapping generation are of about equal duration, since hey occur approximately during the spring and autumn. Further, the curves of larval activity show that the periods of maximum damage are during (1) January, (2) August and September, (3) October and November, and (4) April and May. As illustrated by the chart, the principal periods of pupation—or the subterranean stage of this insect—are, firstly, (1) August to December, and (2) January to May, for the main generation, a few weeks intervening between the cessation and commencement of the December and January periods respectively; and, secondly, (3) June to beginning of October, and (4) from the end of November to the end of March, for the overlapping generation.

Consequently, overlapping of both generations occurs during the following periods: (1) Pupæ—from the end of November to the beginning of December, from January to March, and during August to the beginning of October; (2) larvæ—during the end of August and greater part of September, during November and early December, and from the end of March to the latter part of June. The greatest number of moths of both generations overlap between the end of March and beginning of April.

CONTROL SUGGESTIONS.

(a.) *Artificial Methods.*

From field observations and laboratory experiments it has been found that the most effective results in the control of the flax-grub by means of excessive moisture are to be obtained during the periods

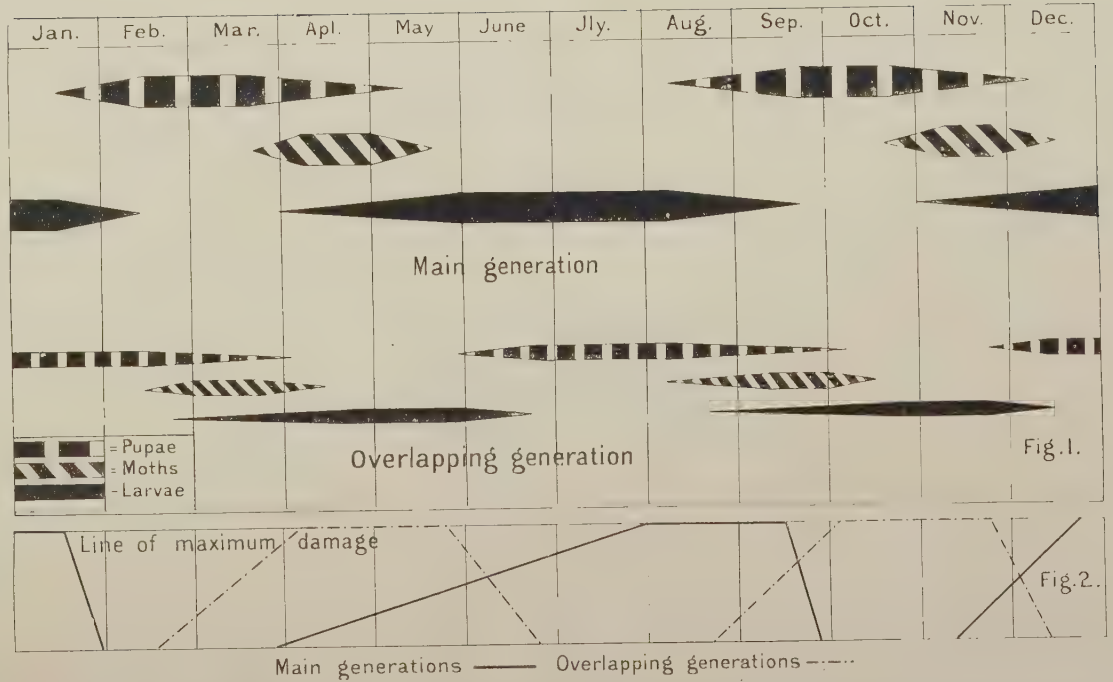


FIG. 1. GRAPH ILLUSTRATING THE SEASONAL LIFE-CYCLE OF THE NEW ZEALAND FLAX-MOTH (XANTHORHOE PRAEFECTATA).
FIG. 2. CURVES OF LARVAL ACTIVITY OF THE FLAX-MOTH.

that the insect is pupating in the ground. If a flood occurs during the hatching of a brood of larvæ a considerable percentage will be destroyed, but many will escape by seeking shelter out of reach of the water, particularly where the flax is dense and dead leaves numerous. Although many young larvæ may be thus destroyed, the moths depositing the eggs are not affected, and oviposition is not hindered. Again, in order to destroy all the larvæ the flax-bushes would necessarily have to be completely submerged, since the larvæ will move up the leaves and seek shelter at the extremities as the water rises; consequently such a method of control on so large a scale as would be required in the Makerua area, for example, would be impracticable. On the other hand, by keeping the soil comparatively moist—as in the case of the Moutoa and southern parts of the Makerua areas—the larvæ on entering the ground in order to pupate would find the soil conditions unfavourable, some being compelled to seek pupation quarters elsewhere, more exposed to the attack of insectivorous birds, &c., while others would perish from the effect of excessive moisture, since humidity is fatal to the insect just at that stage when pupal transformation occurs.

The existence of more than one generation of flax-moths places a difficulty in the way of control by means of the application of moisture, since the periods of pupation and larval activity overlap. However, there are brief periods when, for the most part, both generations are pupating simultaneously, and when flooding should be most effective. Such periods are—(1) from the latter part of July to the end of September, when not only would the hibernating pupæ of the overlapping generation be affected before the moths emerged in August, but also those of the main generation transforming to pupæ in August and September; (2) from December to February, affecting the second brood of the overlapping generation pupating during the former month and that of the main generation during the latter.

In utilizing excessive moisture as a means of control in grub-infested areas it would be advisable to adopt some scheme—for example, by means of artesian wells—by which a more or less uniform soil-humidity could be maintained throughout the year, such as exists in the areas south of Tokomaru. The principle of such a method would be a reticulation of open drains cut throughout the grub-infested areas and fed with a constant supply of water from artesian wells sunk at the various levels of the swamps, the water being carried away by a main arterial drain. The Makerua area—the largest in New Zealand and suffering the most from grub-attack—lies, as already indicated, in a depression, rising to the banks of the Manawatu River on the one hand and to the foothills of the Tararua Range on the other. In this area the drain reticulation could be so arranged to connect with the main channel now running through the middle of the swamp from Linton on the north to the Manawatu River at the south end. If the drains were cut in such a way that by reducing the fall the water would be more or less sluggish, the humidity percentage of the soil enclosed by the reticulation would be increased and maintained by soakage. By this means the humidity of the areas under question could be regulated and a greater amount of water applied in the drier months of the year—that is, from December to March—when not only would the summer pupæ of both generations be reduced, but also the chance of accidental fires be lessened, and the general tone of the swamps improved in relation to the "yellow leaf" problem.

(b.) *Insect Enemies.*

Since the subject of the effect of insect enemies upon the flax-grub was discussed in a former report (*Journal*, December, 1917) more information has been obtained. Of these insects two are parasitic ichneumon wasps (*Ichneumon sp.* and *Paniscus productus*), and one the predaceous larva of a fly (*Syrphus ortas*). Of the two ichneumons, *Ichneumon sp.* was considered of the greater importance, since not only does it confine its attention to the *Xanthorhoe* larvæ, but also destroys these grubs before they are half-developed and, in consequence, before much damage is done to the flax-leaf. On the other hand, *P. productus*, although living in the flax-grub throughout the life of the latter, does not destroy the host grub, but eventually emerges from the pupa after the maximum damage has been done to the leaf. The value of these two parasites is equal in that they both lessen the percentage of moths which otherwise would have developed from the parasitized grubs, consequently causing a reduction of the following brood of larvæ by some two hundred for every individual grub or pupa destroyed; but the greater value of *Ichneumon sp.* is due to the direct reduction of damage and the destruction of a greater percentage of *Xanthorhoe* larvæ. On the other hand, the value of *P. productus* is lessened in that not only is the grub-damage directly unchecked, the reduction occurring in the following generation, but also only a small percentage of *Xanthorhoe* pupæ are attacked, since this parasite has several other hosts. Furthermore, the predaceous fly-larva (*S. ortas*) is advantageous, since several victims are destroyed by one larva, while in the case of the ichneumons only one victim is accounted for by each parasite larva. However, this fly will attack many species of caterpillars according to circumstances, and does not confine its attention sufficiently to the flax-grub to be of permanent value as a means of suppression.

In the report referred to it was stated that *Ichneumon sp.* had not been found in the Makerua area. Recent observations, however, show that the ichneumon exists in that locality, but is itself subject to the attack of a secondary parasite, which bears directly upon the prolificness of the flax-grub, and upon which turns the problem of control of the latter by means of the primary parasite (*Ichneumon sp.*). It is one of the well-known peculiarities of the flax-grub that at some seasons it will appear in abnormal numbers, while at others it is comparatively a nonentity. From the available data, such fluctuations are doubtless due to the influences controlling the secondary parasite, which; when on the increase, reduces the primary parasite (*Ichneumon sp.*), with the result that the flax-grubs, being unchecked, abnormally develop. On the secondary parasite being again subjected to its controlling influences the primary ichneumon will suddenly increase, resulting in a corresponding decrease of the flax-grub.* If the factors governing the secondary parasite could be controlled and the primary parasite left unchecked, a permanent reduction of the flax-grub would be obtained; but this would be a complicated matter, entailing the control of tertiary and probably quaternary controlling factors.

It will be seen from the foregoing that a difficulty arises in controlling the flax-grub by means of its native insect enemies. The

* For further information on this feature, see the writer's article "The Limitation of Injurious Insects by Beneficial Species," in the *Journal* for July, pp. 12–14.

reason for this is that the grub, its food plant, and its insect enemies are all indigenous—the grub and its insect enemies being subjected to the ever-present controlling factors. In order to obtain permanent results by the agency of insect enemies it would be necessary to utilize some parasitic or predaceous foe not influenced in any way by any controlling factor which would hinder its attacks upon the flax-grub. To carry this out an endeavour should be made to discover some exotic enemy controlling species of larvæ allied to the New Zealand flax-grub in other countries, and to establish such a foe in the grub-infested areas of this country, where, being free from the normal controlling factors influencing it in its native territory, it would produce a marked and permanent effect upon the flax-grub.

It is of importance to note that, since *Phormium tenax* has a distribution not only throughout New Zealand but also in Norfolk Island, Chatham Islands, and Auckland Islands, there is a possibility that *Xanthorhoe* exists in these localities, and, if so, may have insect enemies not present in New Zealand. In such a case the rearing and establishment of these enemies in our swamps, removed from any factors controlling such foes in their island homes, would probably give excellent results.

In conclusion, it is noteworthy that in the control of such a pest as the flax-grub the utilization of insect enemies is more advantageous in many ways than mechanical means. The necessary outlay on and upkeep of an irrigation scheme as suggested, although reducing the grub, would be considerable. On the other hand, once an insect foe has become established (though the discovery of such might perhaps entail considerable time and initial expenditure) it will carry on the work of suppression on its own account, or at least with very little attention.

Destruction of Rabbits with Strychnined Oats.—Mr. W. M. Munro, Fields Inspector, Rotherham, North Canterbury, reports as follows:—

"I recently carried out two trials in poisoning rabbits with strychnined oats. On the same ground upon which I conducted the test phosphorized pollard had been laid three weeks previously, but with poor results. The first morning after I had laid the strychnined oats ninety-seven rabbits were picked up, and there were also several others which had been eaten by hawks. This was regarded as a very satisfactory result, but on the second morning, after the trial was repeated, over three hundred rabbits were picked up, several others having again been eaten by hawks. Very little of the oats was to be seen. I have used very many different methods during my experience in rabbit-destruction, but I can confidently state that poisoning with strychnined oats has given by far the most satisfactory results. Poisoning by this method is to be carried out very largely in several parts of my district."

At the Department's Weraroa sale of yearling dairy bulls, on 2nd October, an average of £34 10s. was realized for the twenty-four lots offered. The highest price—112 guineas—was made by the Milking Shorthorn, Dominion Goldfinder, the next being 100 guineas paid for Dominion Domino Dutch Lad, one of the Friesians. Most of the lots went to dairy-farmers.

THE GOOD-ROADS MOVEMENT.

VICTORIAN SYSTEM OF MAIN-ROAD ADMINISTRATION.

By M. H. WYNYARD, President of the Good Roads Association of New Zealand.

In young countries like New Zealand, rapidly developing from a state of nature to modern conditions of cultivation and commerce, it is obvious that, unless guided by a proper system, the advance will be of a ragged nature, with continual rests to bring everything into line. Through centuries of experience the older countries of the world have gradually built up modern civilization with all its ramifications. We have not their years, but if we will we can largely make up for that by taking advantage of their experience. To do this a study of such experience, of present conditions and future possibilities, and a system founded on the result of such study are necessary.

As the progress and prosperity of a State, especially one dependent mainly on the productions of its soil, are largely based on the state of its internal communications, the roading question in this Dominion is a fitting subject to which to apply such study and to deduce a system. Generally speaking, the position is that settlement has been so rapid or far-reaching as to outdistance road-construction, which, so far as concerns main roads, has mostly grown beyond the limit of local bodies' funds. Conditions in some parts of New Zealand—those where metal is scarce and therefore dear—are worse than others. But even where main roads are now good it is certain, with the rapid advance of power-traction, that even these will not stand the heavy traffic of the future. As bearing out this contention, the chief of the Bureau of Public Roads in the United States, in his evidence before the Agricultural Committee of the House of Representatives, in January last, stated, "I fully agree that we are a long way from the ideal road yet. Just as fast as we give something stronger the users quadruple the weights of the loads."

To meet present conditions and future traffic developments in this country a general system is urgently necessary, and doubly so now that we must look to increased production, either directly or indirectly, to meet our heavy war indebtedness. The Good Roads Association of New Zealand has been formed to urge the necessity of systematic control and construction of our main roads. The association has made considerable inquiry, and believes the system in vogue in Victoria since 1912, which has given excellent results there, to be the one best suited to this Dominion. The association is commencing a propaganda for legislation adopting the principles of this scheme, with such variations as local New Zealand conditions may necessitate.

THE VICTORIAN SYSTEM EXPLAINED.

Shortly stated, the Victorian scheme (embodied in the consolidating Country Roads Board Act, 1915, of that State) is as follows:

The Country Roads Board was established comprising three persons appointed for five years, at salaries of £800 a year for the Chairman and £600 a year for the other members. The actual personnel of the Board consists of two experienced road engineers and an officer of the Public Works Department expert in local-government matters. The first duty of the Board was to ascertain and declare what should be "main roads" under the Act, and if these are approved by the Minister of Public Works he recommends the Governor in Council to gazette them as such. Included in this term are not only arterial roads through the country, but the highways carrying considerable traffic between centres of population or to railway systems. The Board was also empowered to collect all data as to materials and methods for road-construction in the various districts, make surveys, and provide for deviations, the improvement of grades, and other preliminary work. Before any road could be declared a main road the Board's proposals had to be sent to the local bodies affected, who had the right to be heard in objection, and, if dissatisfied with the Board's finding, to appeal to the Minister.

The funds for road-construction are provided by the Government up to £400,000 a year. One-half of the amount expended under this head is charged to the various local bodies benefited as a loan on long-repayment terms, on the security of a special rate not to exceed 6d. in the pound on the annual value (equal to about $\frac{3}{10}$d. in the pound on the capital value), and the other half is borne by the Crown. Maintenance of main roads is charged half to the local bodies benefited, and the other half is provided by yearly statutory fees and taxes charged against motor and other vehicles using the roads, and by all other Crown revenue derived from roads or available for road purposes.

The Board prepares particulars and estimates of construction-work proposed on any main road, and submits the same to the Minister, and on obtaining the approval of the Governor in Council the work authorized (unless the Governor in Council directs the same to be undertaken by the Board) is to be carried out by the local authority of the district. Similarly, the local body is (to the amount intimated each year by the Board) to have the administration of the maintenance of the main roads in its district to the satisfaction of the Board.

An important provision is that one-half both of construction and maintenance costs must be charged each year against the local bodies concerned according to *benefits received*, and not necessarily on the basis of mileage through their districts. Moreover, the proportion may be varied according to the ability of the local body to pay, but so that no Council shall pay more than two-thirds of the amount allocated to it. The allocation is made at the end of each year, and the Board must serve notice on each local authority proposed to be charged, giving a very detailed statement of its proposals. This notice fixes a date at least two months ahead upon which to hear objections, and notice of objections are to be served on the Board and other local bodies affected. The Board hears the objections and gives its decision, and from that decision any objector may, in terms provided by the statute, appeal to the Minister.

The foregoing is a brief epitome of the main clauses of the Act, though there are, of course, many machinery and detail provisions

which in a general review of the enactment it is not necessary to enumerate.

THE ACT IN OPERATION.

After the Country Roads Board was formed it proceeded with its preliminary work of declaring main roads, making surveys and deviations, fixing on the most necessary work to commence with, and preparing specifications of the different classes of such roads. This took many months, but it laid down a scheme which could be worked to year by year to culminate ultimately in a completed network of main highways. At the end of the first three years 750 miles of newly constructed road had been completed and 5,500 miles of main road had been "maintained." The whole mileage of the "declared" main roads was under 7,000 miles, so that nearly the whole of this mileage had received attention.

It is important to note that in practice maintenance went in many cases considerably further than keeping the roads in the same state of utility as when taken over. The Board in its report of 1916 stated: "By the judicious expenditure of maintenance funds in the repair, patching, or renewal of the surface of such roads as have been allowed to get into a condition of disrepair they may be gradually brought up to such a good condition that the more expensive work of reconstruction may be postponed indefinitely. In other words, a bad road may be made a good one by a judicious system of repairs or partial renewals."

SOME OBJECTIONS ANSWERED.

A careful perusal of the Victorian statute cannot fail to convince the reader that it is a masterly piece of legislation, and answers most of the objections that any system of comprehensive road-control is bound to meet with. The contributions to the cost are divided between the owners of properties benefited by means of local rating, the users of the main roads by the annual fees charged against motor or other traffic, and the public (who profit by the increased trade) through the Crown by the payments from the State funds. Nor need the Government be afraid of competition against its railways, for any such competition there may be will be largely outweighed by the fact that the majority of the main roads will act as feeders to the railway system and so greatly swell the volume of its goods traffic. The local bodies can concentrate their general revenue on their internal roads, while at the same time the fact that they have the construction and maintenance, under the Board, of the main roads in their districts enables them to provide and keep up good road plants, so making greatly for economy and effectiveness in all their road operations. The provisions of the Act are framed to prevent overlapping and to encourage co-operation between the local authorities and the Board, and in practice in Victoria the utmost harmony has prevailed in the administration of the Act.

It is possible objection may come from a local body whose roads are in good order and reasonably sufficient for present-day traffic. But even such an objection can be met by the reply that if no constructional improvement is required to any main road from which the local body benefits it would not have to contribute to any construction outlay, while it would be relieved of one-half of the cost of maintenance of its

main roads. Moreover, as I have pointed out, what is a good road for the traffic of to-day may not be good enough for the traffic of to-morrow, and will probably require reconstruction in whole or part in the near future to deal with the rapid advance of heavy motor transport.

CONCLUSION.

In conclusion, I would say that, to my mind, the advantages of the Victorian system far outweigh the objections. The system means the co-ordination of work making for consistent lines of efficient highways, the concentration on the most effective and economical methods of road-construction of the whole time and attention of specially qualified road officials and engineers, the economical administration of a large extent of road-mileage under the control of one body, and the devotion of the general revenue and energies of the local authority to its own internal roads.

No one can deny that the solution of the main-road question is one of the greatest "efficiency" needs of New Zealand. Possibly finance may not be immediately available, although as to this it is probably as important a war-time necessity as many others classed under that category, and in any case would largely supersede the present admittedly unsatisfactory and often wasteful system of disconnected Government road grants. But, at least, if the general principles of the Victorian Act are—as I believe they are—the solution we have been looking for, legislation authorizing, when finance is available, a scheme of administration based on these principles should be passed into law, with such amendments as Parliament may think necessary to provide for any varied conditions in our country.

NOTE.—What is known as the good-roads movement is steadily becoming recognized in progressive communities as forming a rural question of first importance, and Mr. Wynyard's lucid exposition of the Victorian main-roads system will be specially appreciated in this respect by *Journal* readers. Certain variations on the Victorian system would almost certainly be necessary for its adoption in New Zealand—as the article anticipates might be the case. The assistance given normally in this Dominion, under the existing system, by the General Government to local bodies, in the shape of subsidies, "thirds," "fourths," direct grants, and actual construction and maintenance of sundry roads and bridges, amounts in the aggregate to a very large sum. Moreover, owing to the elongated physical conformation of New Zealand, the broken nature of much of the country, and the large number of bridges required, the construction and maintenance costs of main roads may be taken as higher than those in countries such as Victoria. The authorities recognize that the matter will have to be faced sooner or later, but the position abounds in complexities, and a comprehensive official inquiry would appear to be advisable in order to establish accurate comparative data, &c. Such a proposal is, we understand, endorsed by the Good Roads Association and would receive every assistance from that organization.—EDITOR, N.Z.J.A.

There is no chemical objection to sowing lime in conjunction with super or guano in top-dressing. The lime makes the superphosphate insoluble in water or "reverts" it, but this is not altogether a disadvantage on acid soils.

A fowl-run should be periodically dug up, sown down, and given a rest. It is obvious that poultry-sick ground is not conducive to the maintenance of the birds in good health.

FIELD-PUMPKINS: WANGANUI EXPERIENCE.

By J. W. DEEM, Fields Supervisor, Wanganui.

SEVERAL farmers in the Wanganui district have grown a few acres of field-pumpkins during the last two or three seasons. The pumpkins are sown in rows 6 ft. to 8 ft. apart and 4 ft. to 6 ft. apart in the rows, three seeds, with a handful of root-manure, being put on each hill. After-cultivation consists of keeping the surface scarified to destroy weeds and preserve moisture until the plants become too close to allow of further horse-work. Planting is done between 20th October and the middle of November, according to the season and location. Crops weighed in June last ran from 8 tons to 13 tons per acre, the heavier crop being an exceptionally fine one. From 8 tons to 10 tons may be accepted as a good average crop for this district.

Pumpkins should be grown in sheltered positions, but where it is desired to grow them in somewhat exposed positions, breaks of maize 4 ft. to 6 ft. wide, should be planted on the windy sides, and similar strips run through the field every 2 chains. If sown in October, and the season is favourable, pumpkins may be fed to stock at the beginning of April. Mr. G. T. Phillips, of No. 2 Line, Wanganui, sowed on 20th October last, and was feeding the crop to lambs by the last week in March. The pumpkins were left in the paddock, kept right through the winter, and were fed up to 10th August.

FEEDING-TESTS.

Mr. Phillips started to feed twenty stud Southdown ewe lambs on pumpkins during the last week in March. The lambs were confined to an area of half an acre, part of which was plantation, and with the exception of 2 cwt. of hay they were fed exclusively on pumpkins up to 15th July. During the whole of this time the lambs had no water. The lambs did well throughout the feeding-period, and when turned out on to grass on 15th July they were fat.

On 18th June a given quantity of pumpkins was weighed, and this was fed to the ewe lambs from 19th June to 15th July. The lambs were given as many pumpkins as they could eat, plus hay. The average consumption of pumpkin per lamb per day was $5\frac{1}{2}$ lb. In the twenty-six days they ate 26 lb. of hay.

A further feeding-test was made with twenty-five stud Southdown ram lambs. They were put on rape in the autumn, but did not do well. Late in May they were confined to half an acre adjoining the ewe lambs and fed on pumpkins. The feeding-test for the ram lambs was similar to that for the ewe lambs, and extended from 19th June to 13th July. In this test the consumption of pumpkin per lamb per day was $4\frac{3}{4}$ lb., while they ate about the same quantity of hay as the ewe lambs. These lambs greatly improved on the pumpkins, and when turned out to grass at the end of the feeding-test they were in good condition.

As an indication of how fond the lambs become of pumpkins it may be mentioned that although they were put on a clean young

grass-paddock in the middle of July it was some weeks before they gave up trying to get back to the pumpkins.

Mr. Phillips also conducted a general feeding-test, as follows: On 1st July 932 full-grown sheep (ewes and wethers) were put into a grass-paddock of 46 acres of ordinary pasture and fed as many pumpkins as they would eat. The test lasted twenty-eight days, and the average consumption was 9 lb. of pumpkin per sheep per day. The whole of these sheep did well. Taking an average crop at 10 tons per acre, this test indicates that an acre of pumpkins would carry eighty sheep for a month of thirty days. It must be noted that July was exceptionally wet and cold, and the consumption of food would probably be above normal.

These tests suggest that pumpkins are a profitable crop to grow for feeding all classes of stock, especially in localities where the growing of turnips and swedes has become difficult. Pumpkins can also follow swedes or turnips. Pumpkins can be grown for feeding from April to July, to be followed by mangolds or other green crops.

The crop is cheaply grown, from 5 lb. to 6 lb. of seed being sufficient to plant an acre. If the seed-bed is well prepared very little after-cultivation is necessary. The carting-out and splitting does not entail much labour, one good cut to each pumpkin being sufficient. A slasher or sharp spade will be found suitable for this work.

It is hoped to conduct further feeding-tests in the district during the season.

HOME SAVING OF VEGETABLE-SEEDS.

By W. H. TAYLOR, Horticulturist.

A NUMBER of correspondents have recently asked for directions for saving their own vegetable-seeds. With some species this may safely be done and involves but little labour, and no particular care is necessary beyond seeing that seed is taken only from good types. Considerable quantities of seed of some of the largely grown vegetables are required, and in some cases it is economical for the home gardener to produce it.

Summer crops of spinach, for instance, produce seeds very quickly, and if a part of a row is left two or three weeks longer than it would otherwise be, seed can be got for the trouble of beating it out on sacking after the heads are dried. In private gardens the leaves are pulled separately for use, and seed can be got from the plants after the crop of leaves is exhausted. Spinach should be sown frequently all through the summer months, and this demands a good deal of seed; therefore it pays to save it. Such was always my own custom when engaged in private gardening.

Lettuce is another similar instance. A lot of seed is required, and it can be saved with safety, provided good types are selected and seeds are produced in a short time. It may be necessary to surround the plants with scrim to protect the seeds from birds, as they are very fond of the seeds and may strip the plants before it is ripe.

Radish also may be saved. In this case, as with lettuce, only one kind must be allowed to flower at a time, for if more than one are

flowering near each other they will become cross-fertilized by the agency of bees, moths, or butterflies, and become hopelessly mixed.

Peas and beans of all kinds can be saved—even several kinds growing near each other. These species are not seriously affected by cross-fertilization, as fertilization takes place before the flowers open. Humble-bees sometimes pierce the tube of the flowers to get pollen, but their depredations are not usually serious. It should, however, be understood that as the peas and beans we grow are not natural plants but are garden hybrids they are liable to sport—that is, vary from the type. The sports may be better or worse than the parent plant. The variations are termed "rogues," and they should be culled out while growing, or if they appear to be an improvement they may be marked and kept separate. The seeds saved should be the first product of the plants, as these are likely to give the strongest progeny. It would be unwise to save the remnant of a crop for seed. If the object be to improve the strain, only pods that contain the full number of seeds should be kept.

Regarding peas, if the bulk of the crop is threshed out a system of cleaning, grading, and culling is necessary. In the commercial seed-houses the peas usually pass through a machine that has four sieves each of a different-sized mesh. The first sieve passes dirt and small rubbish, the second small and broken seeds, the next undersized peas, and the last the seed of proper size. Each lot is discharged into separate receptacles. The final grading is then placed on a bench and sorted by hand. All peas that are not the proper type are culled out, the result being a perfectly clean stock true to type. It will be seen that a vast amount of handling is involved in securing the clean even-sized seeds that are supplied to the public. Many have noticed that some of the peas are green and others nearly white, and want to know the reason. When a quantity is grown the crop must be taken for threshing before the earliest-ripened pods open, and the peas in these are light-coloured. The later pods will mostly be ripe enough, but not so ripe, and these are green. When only a small lot is grown the pods should be gathered by hand as they ripen. These will all be light-coloured. When this plan is adopted only perfect pods should be gathered; this will tend to maintain the vigour of the strain, and may probably improve the latter. A close selection of this kind is not possible with field crops, but the grading process previously described is necessary to prevent serious deterioration. Neither peas nor beans should be saved where the climate is hot and the soil poor, as under those conditions the seeds are sure to be undersized and weak.

Cabbage and cauliflower—in fact, all the brassica family—go to flower if left uncut, and seeds will ripen if the weather is suitable. The great danger is the risk of the varieties crossing each other. It would be a very risky thing to save seed from more than one kind of brassica, and even then it would be useless if a near neighbour had another variety flowering at the same time. Enveloping the heads in butter-cloth would keep bees and butterflies out, but would not provide against wind-blown pollen. There is unavoidable risk in saving small quantities of these seeds, and if the practice were to become anything like general it would prove disastrous. Turnips in particular are often left to flower, and any one wishing to save seed should first make sure that there are no other varieties flowering in the neighbourhood.

Carrots, parsnips, and beets would have to be kept over winter, as they do not seed till the second year. They may be transplanted to another plot for seed-growing, so that the ground they were grown on can be turned over. In such case well-shaped roots should be chosen and all large leaves cut off, carefully preserving the young leaves in the crown. Silver-beet may also be transplanted, merely removing the larger leaves.

As regards onions, well-grown bulbs, true to type, should be selected from the harvested crop, and planted out in spring when they first show signs of growing. The bulbs should be planted deeper than they grow, covering them nearly to the sprout. When the seed-heads are ripe cut them with a piece of stalk and store them in a dry airy shed until the seed falls out readily. Pass the seeds through a fine sieve, and winnow to remove pieces of husk.

Pumpkins, marrows, and other gourds produce seeds freely, but the produce may be quite different from the parent—in fact, if a pure strain is expected only one kind should be grown.

Commercial seed-growers ensure freedom from cross-fertilization by growing large areas of the different species and varieties, and by arranging that varieties of a species are widely separated and protected by intervening blocks of other species. Bees and other pollen-gatherers load themselves from the nearest source of supply; that is to say, when they begin to gather pollen they load up as quickly as they can, and will not wander far if there is plenty of pollen close by. Thus, if they wander, say, from a block of turnips they will not range a long way to find more turnips, but will visit the nearest flowers, whatever those may be, and it is arranged that they shall be another species that will not cross. Such precautions are not possible except on a comparatively large scale.

To sum up, one is forced to the conclusion that, except with the few species mentioned earlier, it is very doubtful policy to save seeds when only small quantities are required. It is safer and more profitable to purchase the seeds, and by care and good cultivation make them go as far as possible.

KEEPING THE SEEDS.

"What is the best way to keep seeds?" is a question often asked. Some suggest airtight bottles or tins, others tins with holes punched in them to admit air. The matter seems to largely depend on how the seeds have been treated. I understand that imported seeds have been subjected to a process of kiln drying, so as to remove as much moisture as possible to enable them to pass undamaged through the tropics. It is probable that such seeds would keep best in airtight receptacles so as to exclude moist air. Home-saved seeds would not be so thoroughly dried, and they might probably contain so much moisture that it would cause decay unless it could escape or be absorbed by the envelope. It appears that in this case paper bags would be best, but, of course, they should be kept in a fairly dry room or shed. Personally, I have never had cause to complain that seeds so stored have not kept long enough. Duration of vitality depends on the seed having been well harvested and thoroughly ripened, and properly kept till time of sowing—neither in a damp place nor where there is too much heat.

Success, also, depends on sowing in a proper manner, in well-prepared soil, and in a suitable temperature. There can be no doubt that failures are often attributed to bad seeds when the sower has been to blame. Seed that has been kept over a season may still have a good percentage of live seeds. Such seed being known to be old is usually sown thickly. This will be quite right if it is a species that germinates in a few days, such as turnip; but if it be carrot or onion, which take about three weeks to come through the soil, the mould generated by the decay of bad seeds may communicate the rot to good seeds, and failure result; whereas if they had been sown more thinly a crop would have been secured. I have known of losses with early peas being distinctly traced to sowing doubtful seed thickly, when the same seed sown extra thin came up in sufficient numbers. Again, the soil in early spring is often subject to more rain than could be desired. If the soil is heavy, however carefully it may have been prepared, the surface is likely to become too close, and it may set under sunshine. In such circumstances, if onions or carrots have been sown so as to save much thinning, the odds are they will fail. I always practise sowing somewhat thick in spring, knowing that where one seed may fail to break through, the additional push of two or three will succeed in breaking the crust. Summer sowings may be made as thinly as possible, as the state of the soil allows practically every seed to come up.

The following list showing the longevity of seeds was compiled by M. de Vilmorin after careful trials. The time of keeping stated is the mean—some individual seeds keep longer and some a shorter time. When the trials gave a lower percentage than 55 per cent. of live seeds they were considered valueless. Therefore at the time stated the trials showed more than 55 per cent. of good seed.

	Years.		Years.		Years.
Bean ..	.. 3	Cress ..	.. 5	Pea ..	.. 3
Beet ..	.. 6	Leek ..	.. 3	Pumpkin	4 or 5
Broccoli	.. 5	Lettuce	.. 5	Radish ..	.. 5
Cabbage	.. 5	Mustard	.. 4	Rhubarb	.. 3
Carrot ..	4 or 5	Onion ..	.. 2	Spinach	.. 5
Cauliflower	.. 5	Parsley ..	.. 3	Tomato	.. 4
Celery ..	.. 8	Parsnip	.. 2	Turnip ..	.. 5

ORCHARD EXPERIMENTAL WORK BY STOKE FRUITGROWERS' ASSOCIATION.

IN the *Journal* for July, 1917, was published an account of orchard experimental work carried out by the Stoke Fruitgrowers' Association in the season of 1916–17. A further series of experiments was undertaken by the association during last season, concerning which a report was read by Mr. W. C. Hyde, Orchard Instructor, Nelson (who is also a member of the Experiments Committee), at a recent meeting of the association, as follows :—

LIME-SULPHUR *versus* ATOMIC SULPHUR AS AN ORCHARD FUNGICIDE AND INSECTICIDE FOR SUMMER APPLICATION.

This experiment was an extension of the test of the previous season, when the relative merits of these sprays was tested as a cure for mildew. The experiment was carried out in the orchard of Mr. T. C. C. Scott. Commercial lime-sulphur, 32° test, was applied to a large block of apple-trees of many varieties, including Sturmer, Dougherty, and Jonathan. At the end of the dormant period it was applied at a strength of 1–20 ; when the blossom-buds first showed colour (9th October) another application was made at a strength of 1–50 ; and a further spraying was given when the flower-petals had fallen (2nd November), the formula being 1–100. This spray was again applied a fortnight later, combined with arsenate of lead at the rate of 3 lb. to 100 gallons of diluted spray-mixture. At the end of November lime-sulphur, 1–120, plus arsenate of lead was applied, followed by an application on 18th December of 1–130 with arsenate of lead, and on 14th and 28th January with lime-sulphur, 1–150, with arsenate of lead. The spray was applied with a coarse Hardie angle nozzle, and at a pressure at the gauge of 200 lb.

A similar block of trees adjoining the first was sprayed with the same brand of lime-sulphur on the occasion of the "dormant" and "pink" spray, but when the petals had fallen atomic sulphur was applied at the rate of 12½ lb. to 100 gallons of water. At intervals of two to three weeks three further applications were made at the rate of 10 lb. atomic sulphur to 100 gallons water ; and in January an application of arsenate of lead only.

During the month of November black-spot was bad on the foliage of the Doughertys in the block sprayed with atomic sulphur, while the same variety in other sections was not affected. This fact caused some anxiety at the time, and the next application of atomic sulphur was made at once instead of waiting for the usual interval. At the end of March also a slight attack of black-spot was experienced on both sections, but was more marked on the section sprayed with atomic sulphur. Otherwise the crop on these sections at the time of picking was bright and clear, of good colour, and free from stings. The foliage on the lime-sulphur section was in the better condition, and in some cases the

fruit was brighter. This experience endorses the conclusion arrived at as a result of our experiments with these sprays last season. Dealing with the matter of cost, atomic sulphur at 9d. per pound and at 1–10 formula costs 7s. 6d. per 100 gallons of spray, while lime-sulphur, 32°, at 2s. 3d. per gallon at 1–100 formula costs 2s. 3d. per 100 gallons of summer spray.

"BLACK-SPOT" REMEDIES.

(1.) *Bordeaux on Dougherty Apple-trees.*—This was again tested in the orchard of Mr. Scott. On 24th September, just as the buds were moving, bordeaux of winter strength, 8–6–40, was applied. On 16th October, when the blossom was half out, bordeaux was applied at a strength of 3–4–40. The test was made to prove the consistency of last year's experience with bordeaux on Dougherty apple-trees and Chaumontel pears. When examined on 9th November the trees sprayed as mentioned were found to be more forward than similar trees sprayed with lime-sulphur, the extra vigour being very marked. The further spraying of these trees was made with lime-sulphur, and on 5th April it was found a good crop had been matured, without "spot" or russet, well coloured, and a large percentage of 3 in. fruit.

(2.) *On Difficult Trees in a Bad Locality:* i.e., *Heavy Wet Land.*—The experiments with black-spot which were found so successful in 1916–17 were carried out under rather advantageous conditions. A natural desire was therefore felt that the same test should be repeated on a variety of apple more susceptible to the fungus and in a locality where the soil was heavier. Two rows of Sturmer trees at the foot of a natural terrace in the orchard of Mr. Harry Pickup were selected for this season's experiment. These trees are nine years old and very uneven in condition. By far the best row was sprayed with lime-sulphur throughout the season, commencing on 13th September when the trees were dormant, with the compound at 32°, 1–10; and another application was given on 11th October, when the trees were opening their blossom, the formula being 1–60. The same strength was applied, with arsenate of lead added, on 7th November, when the petals had fallen and the fruit set. A further application of lime-sulphur, 1–100, with arsenate of lead, was given early in December, while two applications of arsenate of lead only were applied in January and February respectively.

A number of Sturmer trees in the other row were sprayed on 7th September, the trees being dormant, with bordeaux, 8–6–40. On 17th October, the blossom then being nearly out, lime-sulphur, 32°, 1–50, was applied. On 12th November, the fruit having set, lime-sulphur, 1–100, with arsenate of lead, was applied, and on 5th December this application was repeated. A couple of applications of arsenate of lead only were applied early in the new year.

The remainder of the Sturmer trees in this second row were sprayed with bluestone, 1–20, on 6th September, the trees being dormant; and further applications were exactly similar to the preceding.

When inspected on 6th November, after the "pink" spray and when the fruit had about set, all the trees referred to under this heading were in good condition except two which had suffered from water about the roots. A similar report is entered in the notes on 5th December. On 13th May autumn "spot" was found attacking the crop on these

trees. It was decidedly worse on the trees sprayed with lime-sulphur only, otherwise the crop was heavy, of moderate size, bright, well coloured, and free from russet.

(3.) *Soil-dressing with Lime.*—The relation of soil-acidity to the black-spot fungus on apple-trees growing in such soil has been much discussed. The subjects of this experiment were Sturmer trees in Mr. Pickup's orchard. The trees received the usual first two applications of lime-sulphur in spring—that is, the "dormant" and "pink" spray. This was followed on 4th October with a dressing of air-slaked lime—15 lb. to each tree. The remaining sprays were arsenate of lead only. The result of this treatment was quite unsatisfactory, the black-spot fungus being very bad on these trees. No doubt the point at issue would be given a fairer trial if the lime were applied over the entire surface of a rather large area and very much earlier in the season.

(4.) *Bluestone Solution.*—Sturmer trees in Mr. Pickup's orchard were the subject of this test. On 6th September a "dormant" spray of bluestone, 1–20, was applied. On 15th October, the trees being in excellent condition and the blossom opening, a spray was applied consisting of 1 lb. bluestone to 50 gallons water. Two days later it was noticed that the foliage was slightly burned, and on 6th November, when inspected, it was found the leaves had fallen badly and only a small crop had set, the trees otherwise looking well. It was decided to reduce the strength of future applications, and on 12th November an application of bluestone, 1–100, was applied. On 5th December leaf-dropping and fruit-russeting were found to be so bad that it was decided to abandon the experiment. At the end of the season the trees looked very well and were carrying a small crop of bright but russeted fruit.

(5.) *Fungus Spray (Lime-sulphur or Bordeaux) applied in Early Spring and followed immediately by an Application of Red Oil.*—Much has been said regarding this combination, and, among other things, it is claimed that the fungicide will remain effective for a longer period—in fact, that further applications are unnecessary during the remainder of the season. Mr. F. J. Hall carried out the following experimental work on this question, inspection being made with him on 7th December. The trees dealt with were five-year-old Sturmers, all of which had received a dormant spray of lime-sulphur, 25°, 1–10.

Section 1 was sprayed, when the blossom was opening, with bordeaux, 8–6–40, immediately followed by emulsified red oil, 1–60. At the time of inspection the trees carried three-fourths of a case of clean well-developed fruit, although considerable "spot" showed soon after this application.

Section 2 was sprayed, at the same period as the preceding, with bordeaux, 3–4–40, immediately followed by oil, 1–60. These trees were carrying a good clean crop, and impressed Mr. Hall as forming the best in these experiments.

Section 3 was sprayed, when about to blossom, with lime-sulphur, 25°, 1–40, immediately followed by red oil, 1–60. When inspected some "spot" was showing, but the general condition was good.

Section 4 consisted of check-trees, which had no "pink" spray, but were otherwise treated the same as the others. At the time of

inspection a number of apples affected with black-spot were found on them. After the fruit had set black-spot became so prevalent that a further spray of atomic sulphur, 3 lb. to 100 gallons water, was applied to all the trees in the sections. Mr. Hall was of the opinion that the "calyx" spray could not be dispensed with, and no doubt this experience points very strongly in that direction, but further trial is needed before the question is decided.

NAPHTHALENE LIME-SULPHUR.

This new spray was put on the market in the past season for the first time, and claims to be a combined fungicide and insecticide. It was tested on a block of apple-trees—Rokewood and Rome Beauty—in the orchard of Mr. Scott. The first application was made on 24th September, at a strength of 1–10, the Rokewoods just breaking their buds and the Rome Beauties dormant. On 10th October, when the blossoms commenced to open, naphthalene lime-sulphur was applied at a strength of 1–50. A further application was given when the petals had fallen, on 9th November, at 1–100; and this was repeated on 5th December, when arsenate of lead was added to the mixture. The further spraying of this block consisted of arsenate of lead only.

The Rokewoods in this block at the beginning of the season (as is so common with that variety) were affected with woolly aphis rather badly, old-established colonies having caused considerable disfigurement. When inspected on 5th December very little aphis was showing, and the foliage and fruit looked particularly well. In April, when the fruit was picked, the trees compared well with trees sprayed with lime-sulphur, the fruit being clean and bright, and the general condition of the tree good, the infection of woolly aphis being considerably reduced. In these applications well-water was used, and arsenate of lead used in combination, without the least sign of burning being experienced at any time. The addition of naphthalene seems to thicken the spray and give greater adhesion, and further tests with this mixture will be of great interest. The price per gallon is the same as that of ordinary commercial lime-sulphur.

ORCHARD SANITATION.

The stress laid on this subject by scientific writers and some local growers during recent years is no doubt timely. Abundant and thorough cultivation in the orchard is a very fine thing, but, as the writers in question have pointed out, such cultivation is infinitely more effective if it is done with discrimination and consideration given to its relation to orchard insects and fungi.

The experiment under this heading was carried out in the orchard of Mr. Lightband, of Brightwater. Unfortunately, the results have been heavily discounted by the fact that owing to its situation close observation of the experiment throughout the season was not maintained. The time taken up by these experiments is very considerable, and it is to be hoped an organization with more time and money for the purpose will very soon come to our assistance in the work, which is of such general benefit to the fruitgrowing industry in Nelson.

The experiment was carried out on a large block of Sturmer apple-trees. During the previous season no spraying had been done, as the

trees were unsatisfactory, and it had been decided to pull them out, the position being a bad one for black-spot fungus. When dormant the trees received a good dressing of lime-sulphur (winter strength), and before the "winter" or "resting" spores from the fungus-infected foliage became active the section was carefully ploughed. (Note.—This experiment does not consist of a treatment that is new, except that cultivation all through the season was considered from the point of view of counteracting fungus-infection, as well as the vigour of the trees.) The ploughing was done before the buds started in spring, and was "off" the trees, the plough being set to reduce the strips between the trees as much as possible; in fact, it was reduced to a diamond-shaped piece of ground round each trunk, and this, too, was afterwards turned right over and the land harrowed. No further cultivation was done for about two months, when the land was thoroughly disked and harrowed. The only spraying throughout the growing season consisted of arsenate of lead. The crop when inspected after it had been picked looked well, the skin of the fruit being very clear. A careful count was made, and it was found 40 per cent. of the number of apples had been infected with black-spot. The count is large, but a very great number of those counted out were infected only to the extent of a spot about $\frac{1}{8}$ in. in diameter—in fact, the majority were apples of that description. The previous season's crop was very badly infected.

It should be noted here that the experiment was carried out as described—without summer spraying—merely to test the effect of such a system of cultivation. Not a single advocate of the system suggests that summer spraying should be dispensed with altogether.

BROWN-ROT OF PEACHES: IS LIME-SULPHUR SUMMER SPRAYING SAFE AND EFFECTIVE?

In connection with this experiment Mr. Scott sprayed two rows of Muir peaches in his orchard with lime-sulphur, 1–150, one month after the fruit had set. A number of trees of the same variety were left unsprayed on this occasion as a check. About a month before picking a number of these peach-trees received a second summer spraying of lime-sulphur at a strength of 1–120. At the time of picking there was a marked improvement in the crop from those trees which had received the double summer spray. Trees which received one summer spray and those which had none during summer show little difference between each other as far as crop-infection is concerned. The infection on this block of Muir peaches—a variety very susceptible to brown-rot—was generally low, a condition no doubt due to the double spring spraying they have received in the past.

Owing to the prevalence of brown-rot during the first few weeks of this year, a grower made inquiry regarding treatment for a crop of Salway peaches (which are very subject to the disease) then maturing. It was decided to apply atomic sulphur to one-half the number of trees, and lime-sulphur (commercial) to the other, a few trees being left unsprayed as a check. This was done on 21st February, when the weather was bright and hot. Atomic sulphur, 15 lb. to 100 gallons water, was applied to the trees on one section, and lime-sulphur, 1–125, was applied to the trees on the other. No spray injury of any kind was observed.

The crop was picked on 5th March, when the fruit was coloured but quite firm, and marketed satisfactorily. A sample of fruit was put into store from each plot and examined on 16th March, when it was found that the peaches which had received the atomic-sulphur summer spray had a 40-per-cent. infection of brown-rot. Those which had received the lime-sulphur summer spray had a 12-per-cent. infection. And—very unexpectedly—the sample of fruit from trees which received no summer spray was quite clean on the date of inspection. Another set of samples which when picked had been treated with borax solution, 4 oz. to the gallon of water, gave the same result.

Inquiring into the history of the check-trees which gave such unexpected results, it was found they had been sprayed with bordeaux, 8–6–40, as the buds were breaking. Later, having a quantity of bordeaux (3–4–40) to spare, and slight leaf-curl showing on a few Salway trees at the ends of the rows, it was applied to these trees when the fruit was about the size of small walnuts. About 10 per cent. of the foliage dropped as a result of this application (probably foliage infected with leaf-curl), but the trees recovered quickly and finished well. The winter treatment for the majority of the trees, including those summer-sprayed with atomic sulphur or lime-sulphur, was lime-sulphur 1–10, applied when the buds were beginning to swell. At the time of inspection the Salway trees sprayed with bordeaux at the end of winter (1917) were looking much the best; the foliage being larger, better coloured, and with little or no "rust."

SUMMARY OF RESULTS.

(1.) Lime-sulphur has again demonstrated its superiority over atomic sulphur as a general summer fungicide in the orchard.

(2.) The invigorating effect of spring applications of bordeaux to Dougherty apple-trees is confirmed.

(3.) On Sturmer apple-trees, in a locality favourable to black-spot, bordeaux spraying followed by applications of lime-sulphur gave better results than a full series of lime-sulphur spraying only—and without russeting the fruit.

(4.) Weak solutions of bluestone as a summer spray for apple-trees proved impracticable.

(5.) Fungus-spray immediately followed by oil in spring on Sturmer apple-trees did not give encouraging results from the point of view of economy.

(6.) Naphthalene lime-sulphur gave very promising results as a commercial fungicide and contact insecticide.

(7.) The proper timing of orchard cultivation has an important bearing on the fungus-infection of orchard-trees.

(8.) Regarding the summer spraying of peaches for brown-rot fungus, the experiments carried out proved that lime-sulphur, 1–125, and atomic sulphur, 15 lb. to 100 gallons water, can be applied to peach-trees in summer without burning them; they also indicated that summer sprays of lime-sulphur are a better preventive of brown-rot than atomic sulphur so applied; also that bordeaux is a more effective spring spray for peaches than lime-sulphur.

STRATFORD MODEL DAIRY FARM.

THE FIRST YEAR'S OPERATIONS.

By J. W. DEEM, Fields Supervisor, Wanganui.

AN account of the formation and initial work of the Stratford Model Dairy Farm and Experimental Area Society (Incorporated) was given in the *Journal* for December, 1917. The notes which follow touch on some of the chief features of the first year's operations, covering the 1917–18 season, and the present position of the organization.

It was mentioned in the previous article that the farm buildings and fences were in a very dilapidated condition when the property was taken over, also that most of the land was still in stumps. The first work the managing committee had to put in hand was therefore the erection of a cow-shed and yards, repairing of fences, and stumping a suitable area on which to grow root and fodder crops for the dairy herd. After careful inquiry it was decided to build in concrete an eight-bail walk-through shed suitable for machines, together with a concrete milk-stand and trap-shed combined, and a concreted yard. Looking ahead, accommodation was provided for a herd of sixty cows. The shed was fitted up with a Ridd milking-machine and releaser plant complete, driven by a 3 horse-power electric motor drawing current from the Stratford Borough supply. Both the machine and the electric plant have given satisfaction. The erection of the shed and yards was a "rush job," carried out in very bad weather, and in the circumstances the cost of £375 cannot be considered excessive.

The stumping of 20 acres was put in hand as soon as the committee secured possession of the farm, and this area was ready in time to be sown in root and fodder crops suitable for a dairy herd. The crops generally were successful, and provided ample fodder for both the herd and dry stock during the autumn, winter, and early spring. Moreover, a surplus of over 40 tons of mangolds was sold to dairy-farmers in the neighbourhood. It may be mentioned that fifty-six cows and springing heifers, twenty-one yearlings, one bull, and four horses were wintered on the farm, and came through in splendid condition notwithstanding the exceptionally severe weather experienced.

During the season eighteen cows and twelve heifers were milked. Although these were late calvers (a number not coming into profit until November), and all the animals were bought in the open market late in the season when all the best clearing sales were over, the herd averaged 203·6 lb. of butter-fat. In the circumstances this must be regarded as very satisfactory, and illustrates what can be done by good feeding. This season it is hoped to milk a herd of upwards of forty.

The experiments undertaken were confined to methods of growing crops, top-dressing of pastures, variety trials of root and fodder crops, and manurial trials of roots. During the year a further 15 acres have been stumped and ploughed for this season's root crops; nearly two miles of new fences have been erected; and a mile of barberry hedges has been planted, also six hundred shelter-trees.

Scholars attending the Stratford High School have made fairly frequent visits to the farm for observation work. They have also tested

the herd, and assisted in cleaning the mangold crop. Owing to several changes in the staff of the Taranaki Education Board during the year the Instructor and pupils have not been able to spend as much time on the farm as they would have liked, but they hope to make more use of the place this season.

The balance-sheet, after writing off £62 17s. 8d. for depreciation on plant and buildings, shows a profit on the general fund account of £208 6s., or, if the Government subsidy of £300 is omitted, a loss of £91 13s. 11d. When it is remembered that the society has had to pay for practically all work done, also pay bank overdraft interest on every pound spent on the place, this result must be considered satisfactory. A large number of farmers and others visited the farm during the year and expressed their appreciation of the work being carried out. The place, in fact, is already proving its usefulness.

Owing to pressure of private business Messrs. J. W. Boon and F. Ranford retired from the committee at the end of the season. Their places have been filled by Mr. Wickham, of Ngaire, and Mr. R. Masters, Chairman of the Taranaki Education Board.

At the conclusion of the ordinary business at the annual meeting of the society—held at Stratford on 31st August—the writer, as chairman of the committee, gave a short address reviewing the work of the year and dealing with the growing and manuring of root crops generally in the district. This led to a very useful discussion and exchange of ideas. It is hoped to foster this phase of the work, so that as time goes on the society, in addition to operating the model farm, may become a local bureau for information in farming matters generally.

PASSION-FRUIT CULTURE.

By J. H. DAVIDSON, Manager of the Tauranga Horticultural Station.

THE passion-vine (*Passiflora edulis*), although naturalized in most tropical countries, is a native of Brazil. The cultivation of the plant in New Zealand is chiefly in the North and in districts where there is little or no frost. It appears to thrive well on almost any class of soil, even when the latter is poor. The vines come into profit early, and are practically exhausted when they have attained the age of six or seven years. In order to get the maximum amount of fruit from them they should therefore be well cultivated and manured. Their most productive period is before they attain the age of four years, but plants may be kept in profit for a few years longer if they have been well cared for.

PROPAGATION.

Young plants are raised either from seed or from cuttings, the former mode being the simplest and most satisfactory. The largest and most uniform fruits should be selected for seed, and these only from the most vigorous and prolific plants. On being removed from

the fruit the seeds simply require washing, and they should be planted immediately, as if they are allowed to become too dry their germination is greatly retarded. The seeds may be sown in a bed in a well-sheltered and warm location, in rows 2 ft. apart, afterwards thinning out the young plants to 6 in. apart in the rows. If only a small number of plants are required the seed can be sown in boxes and placed in a cold frame, the seedlings being transplanted into other boxes when large enough to handle, and kept in the frame all winter.

For raising plants from cuttings artificial bottom heat is required in order to obtain the best results, and it will be advantageous to cover the cuttings with glass; the loss of moisture will then be checked and root-production hastened. Cuttings should also be selected from the best bearing plants and be taken in the spring. The wood selected should be young but not soft, 5 in. in length, and with a heel of the previous season's growth at its base. Insert the cuttings in clean sand, leaving only two buds out. The cutting-bed must be made firm, and the cuttings put in tightly and close together, as they are to be removed as soon as they have developed roots, which will be in six or seven weeks. Plant either in boxes or singly in 2½ in. pots, and gradually harden off the plants.

PLANTING, TRAINING, AND PRUNING.

In selecting a site for planting, situations where frosts are severe should be avoided, for the passion-vine will not stand much frost. If convenient the rows should run north and south, so that the plants get the sunlight on both sides. It is an advantage to erect a trellis to support the vines before planting out. This is done by setting 7 ft. posts in the ground to a depth of 2 ft., at a distance of 24 ft. apart in the rows, and 10 ft. apart between the rows. On the top of each post secure a cross-piece of timber 9 in. long, and to these cross-pieces attach two No. 8 wires. Stakes are now set 12 ft. apart, and firmly tied to the wire overhead for the purpose of supporting the vines until they reach the wires. The month of September is the best time for planting; there is no advantage in setting the plants out earlier. Train the young vines up the stakes with a single stem by pinching out all laterals until the wires are reached. Four laterals are then allowed to grow, two of them to be trained each way along the wires. The laterals are now left, as the fruit is borne on them, and are allowed to droop down from the wires.

As the passion-vine bears its fruit on new wood, it should be regularly pruned by cutting the laterals back to two buds, from which other fruit-bearing shoots will develop. In mild and well-protected locations the plants will produce two crops in the year. The summer crop comes in at a time when there is usually an abundance of other fruits on the market, and the prices realized are often anything but satisfactory. When the summer crop is about half-grown prune it away; this will be towards the end of November. The plants are thus stimulated to throw out fresh fruiting-wood, and the fruit will ripen at a time when the markets are not overstocked with other fruits. The grower will thus be better compensated than if he had marketed a heavy summer crop.

INSECT PESTS.

The greatest enemies of the passion-vine are mealy bug and the vine-hopper, and once a plant has become badly infested it is hopeless to eradicate these pests unless by fumigation with hydrocyanic gas. This, however, is not worth the expense; it is far better to pull up the plants and burn them. These pests are usually worst where plants are neglected and unpruned. If the laterals are regularly cut back each year there is little harbour for disease, and the vines will continue growing and bearing for a longer period.

NOTE BY THE HORTICULTURIST.

Passion-fruit is largely grown in Australia. Experience in that country shows that the number of years the vines maintain a profitable condition is largely dependent on the quality of the soil, and manuring. In Australia this vine bears three large crops of fruit each year—that is to say, is in an almost perpetual state of bearing. It is not to be expected that the plant can bear this strain without the application of proper fertilizers. Kainit and other manures rich in potash have been found best. As potassic fertilizers are at present practically unobtainable, care should be taken to preserve wood-ashes. These contain a considerable amount of potash, and should be liberally applied, strewn over the soil-surface covering the estimated root-run. Superphosphate also may be given at the rate of 2 oz. per square yard, applied during winter. Strict attention to pruning is emphasized. Cold heavy soils are unsuitable. The fruit crops are generally poor on such soils after the first two years. Frost does severe injury to the vine, resulting in poor crops and often imperfect fruit. Cold winds may have a like effect. Where the soil is good, manuring attended to, and pruning properly done, the vines may be profitable for ten or twelve years, but, generally speaking, the best period is the first four years of bearing.

A disease that causes what is termed woodiness in the fruit has given some trouble in Australia, and has also appeared in New Zealand. The signs of the disease are a hardness of the shell, with possible cracking or blotches of a brown colour, and want of fruity pulp. The fruit generally assumes an unnatural green colour. The cause of the disease is obscure, but as it is accompanied with infertile seeds it is evident the disease exists before the fruit is set. It is therefore assumed that spraying with bordeaux mixture at summer strength before blossoming, and again when the fruit is set, should be effective in its control.—*W. H. T.*

The Orchard-tax.—Fruitgrowers are reminded that the orchard-tax for 1918 is payable from the 1st November, and are requested to make their payments promptly, thereby reducing to a minimum the heavy work of collection. The tax is levied for the benefit of fruitgrowers, and no charge is made by the Department for its share of the work.

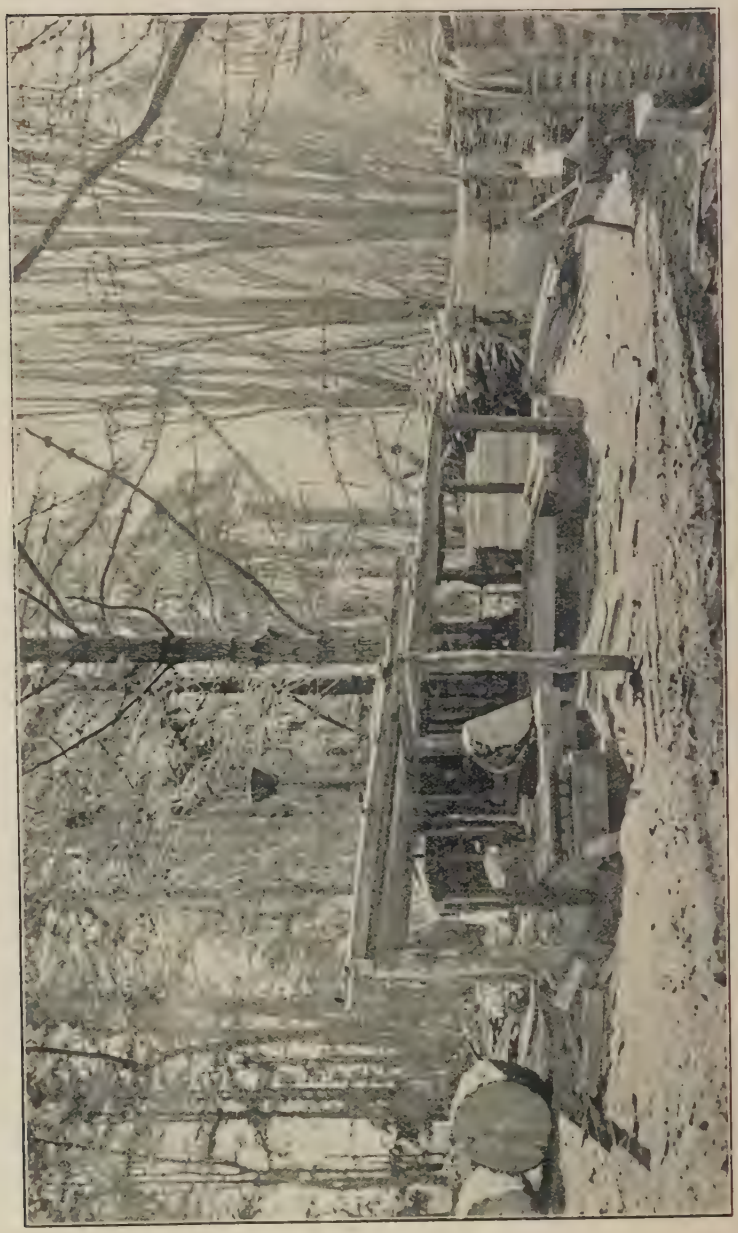
PINUS INSIGNIS FOR FRUIT-CASES.

A PRACTICAL demonstration of the value of plantations of insignis pine (*P. insignis* or *radiata*) in relation to the fruitgrowing industry is now in progress near Hastings, Hawke's Bay. The plantation in question was made between thirty and forty years ago by the late Mr. Thomas Tanner, an old settler in the district. It was recently purchased by Messrs. Apsey, White, and Co. Ltd., of Hastings, in connection with their fruit-handling and cool-storage business. The price of white-pine fruit-cases supplied by the ordinary timber-mills has been steadily advancing during the last few years, and now ranges about 1s. 1d. for the bushel size, or approximately 100 per cent. higher than in 1913. In order to test the position with a view to reducing costs, the firm named decided to undertake the local venture of milling and case-making on its own account. The plantation extended more or less irregularly over some 6 acres, and comprised about 800 millable trees. Although the plantation had not been raised specially for timber purposes, the trees as a whole were well grown, many measuring 100 ft. to 150 ft. in height and 3 ft. to 3 ft. 6 in. in diameter. The trees are estimated to yield an average of 1,250 superficial feet of sawn timber, and the whole plantation 1,000,000 ft., this providing—at 5 ft. 6 in. to the bushel case, and allowing for a certain proportion of the smaller sizes—approximately 200,000 cases.

The milling plant installed consists of a 54 in. breaking-down saw, a 36 in. second saw for boards, and a 24 in. crosscut saw, together with an emery sharpening-wheel, the whole being driven by a 9 horse-power portable engine. With the exception of the iron roofing the mill was constructed entirely of timber cut out of the plantation itself, and the engine is fired exclusively on waste wood, cones, &c. The fitting-up of the plant was carried out by the working mill-manager, Mr. W. Tracey. Operations have proceeded smoothly, and over 40,000 cases have been turned out since Easter. The enterprise being undertaken primarily for the firm's own business and connection, most of the cases are made up on the spot, from whence they are taken by fruitgrowers as required. Detailed costing accounts are not available at present, but it is understood that the cost of the bushel case in the shook works out near 10d., to which is added another penny when the case is put together.

The suitability of insignis-pine timber for fruit-cases is fully confirmed by this experience. It has sufficient strength, holds nails well, and presents a nice clean appearance in the finished article. There is found to be remarkably little waste in the milling, down to very small stuff being utilized for the lesser sizes of cases. It may be added that Messrs. Apsey, White, and Co. have recently experimented with silver-poplar for fruit-cases, and find it not nearly so good as insignis pine in cool store. It mildews very much, and the nails, even if they become rusty, pull out of it badly.

A picture of the plantation mill is given on the following page.



MILLING PINUS INSIGNIS FOR FRUIT-CASES NEAR HASTINGS (SEE PRECEDING PAGE).

WORK FOR THE COMING MONTH.

THE ORCHARD.

THE indications, climatic and otherwise, point to a good fruit season, and if these conditions continue for a few weeks longer damage from fungus diseases should be considerably less than for several years past. Nevertheless, the frequent application of fungicides with a view to destroying the heavy supply of fungus-spores consequent on previous bad seasons is necessary if full advantage of the existing conditions is to be gained. Where this is not thoroughly done more or less serious outbreaks of disease may be expected immediately unfavourable weather sets in. District notes of advice follow.—*J. A. C.*

AUCKLAND.

The most important operations to be carried out in November are completion of cross-ploughing, followed by disk-harrowing; cultivating; spraying for codlin-moth, leaf-roller caterpillar, &c.; spraying for control of black-spot of pip-fruits and brown-rot of stone-fruits.

Black-spot, bitter-rot, &c.: Following on from directions given in last month's notes, growers are advised to watch their opportunity to put on the first and subsequent sprayings. The first summer spray, bordeaux 3–4–40, may be combined with arsenate or lead. Subsequent sprays, which may also, if required, be added to arsenate-of-lead spray, should be either bordeaux, 2–3–40, or lime-sulphur, 1–100 (or 1–120 with tender-skinned varieties).

Codlin-moth, leaf-roller caterpillar, &c.: The directions set down for last month's work with reference to pears apply also to apples during November for the control of these pests.

Brown-rot of stone-fruits: Owing to the much-improved weather conditions ruling in the Auckland District at the time of pollination of peach, nectarine, and plum-blossoms, as compared with those of last season, infection from this fungus is at the time of writing (fruit set) very much lighter than at this period of 1917. Growers are advised to spray, one month after the "fruit-set" application, with either self-boiled lime-sulphur, 8–8–50, or commercial lime-sulphur, 1–125. In making up the self-boiled lime-sulphur it is imperative that the lime should be *fresh roche*, and that hot water should be used for the commencement of the slaking. If infection from brown-rot in the stone-fruit orchard is to be kept down to a minimum, the necessity for the detection of infected fruit should not be overlooked. All such fruits should be removed from the orchard, and either burned or buried sufficiently deep to ensure against the spread of further spores of the disease.

Disbudding young trees: Areas of newly planted trees will need to be gone through and disbudding carried out. Retain all shoots which are required to furnish the tree with sufficient foundation and frame, always allowing for the few that may be broken by the wind or other unforeseen contingencies. All other shoots should now be entirely removed by rubbing out with the thumb.

Citrus fruits: Most varieties of oranges will be showing full bloom this month, as also will Lisbon and Eureka lemons, where they have sufficiently recovered from the effects of frost during July last. As soon as the lemon-bloom petals have dropped from the embryo fruits the first application of bordeaux (4–4–40) should be made for the control of verrucosis and grey-scab.

Spraying summary: Spraying for the month is recommended as under:—

Peach, nectarine, and plum: Commercial lime-sulphur, 1–125, or self-boiled lime-sulphur, 8–8–50—one month after fruit set.

Pear, apple, and quince: Bordeaux, 3–4–40—when fruit set; bordeaux, 2–3–40, or commercial lime-sulphur, 1–100—three weeks later; in combination

with arsenate-of-lead paste, 1½ lb. (or powder, ¾ lb.) to 50 gallons of water—when blossom-petals fall. Applications as required (see last month's notes).

Lemon and orange: Bordeaux, 4–4–40—when blossom-petals fall.

Strawberry-culture: The attention of strawberry-growers is directed to the necessity of keeping the soil around the plants and between the rows well broken up before the application of the mulch. Dry weather may set in suddenly, and where such has not been provided for by surface irrigation the plant may be so severely checked at this critical period as to materially curtail its fruiting season.

—*J. W. Collard, Orchard Instructor, Auckland.*

HAWKE'S BAY.

Spraying: Keep a close watch for black-spot. Lime-sulphur, 1–100, should now keep this in check, but use bordeaux, 3–4–50, if it is troublesome, this being the better fungicide. Spray mildew-affected varieties with lime-sulphur or atomic sulphur at intervals of about a month. All pip-fruits require to be sprayed at intervals of about three weeks with arsenate-of-lead paste, 1½ lb. (or powder, ¾ lb.) to 50 gallons water. Spray plums and pears for leech, 1 lb. arsenate of lead to 50 gallons water, but substitute hellebore powder towards the ripening-stages on plums. Also spray cherries with the hellebore for the same trouble. Spray English plums with bordeaux, 3–4–50, or lime-sulphur, 1–100, for rust.

Combined lime-sulphur and arsenate of lead: This is a popular spray on account of the dual purpose which it serves. Unfortunately, it has done a good deal of spray damage in this district, and should be used with care. The addition of lime to the arsenate is a wise precaution—using a little more weight of lime than arsenate. Use lime-sulphur, when combined, at 1–120 to 130. Be sure all sediment is drained out of each barrel of spray before a fresh lot is put in.

General: A start can be made thinning the stone-fruits in November; this work should be completed before they stone. Keep the ground well cultivated; the importance of this operation cannot be overestimated.

—*G. Esam, Orchard Instructor, Hastings.*

NELSON.

Spraying stone-fruits: The lime-sulphur or bordeaux spray recommended last month can be repeated with great advantage where brown-rot has been troublesome during the previous season. The former is also effective for San Jose scale. Regarding brown-rot fungus, it is to be remembered all experiments have shown the most careful spraying has little result unless the mummied fruits of last season and the present are collected and properly destroyed.

Spraying pip-fruits: As the petals fall the calyx-spray can be applied to pear and apple trees. Owing to the ravages of leaf-roller and codlin-moth, it is advisable to include arsenate of lead in this formula. Lime-sulphur, 32° test, 1 gallon, and arsenate-of-lead paste, 3 lb. (or 1½ lb. powder) to 100 gallons of water, will be the formula most generally useful. On the more hardy varieties of apple and pear trees the quantity of water can be reduced to 80 gallons. After an interval of ten days or a fortnight lime-sulphur, 1–100, with arsenate of lead should be repeated. Results will depend chiefly on the care in mixing and the thoroughness of the application.

Cultivation: Throughout November, provided the ground is in condition, thorough cultivation should be maintained.

Grafting: Grafts that have failed can be reworked if scions are available. All new growth on the stock should be kept pinched back.

Disbudding: Much time is saved in developing young fruit-trees if a little supervision is given to the young growth at this season. Strong growth in unsuitable parts of the tree should be stopped, and in some cases suppressed altogether.

Thinning the fruit: This is a most important operation in the Nelson District. In past seasons many a grower has congratulated himself on a handsome crop, only to find when it is gathered that the major part of it has to be graded out as culls. This disappointment can be avoided by early thinning of the fruit to enable the summer sprays to cover and protect that which is allowed to remain. Any blossom or fruit about the tops of the leaders, and for a foot or two down, should be removed early in the season. These remarks apply specially to Sturmer and Jonathan, and all short-stemmed varieties.

—*W. C. Hyde, Orchard Instructor, Nelson.*

CANTERBURY.

For the control of chewing-insects spray with arsenate of lead at a strength of ¾ lb. of powder or 1½ lb. of paste to 50 gallons of water. Spraying for codlin-moth should be commenced as soon as bloom-petals have fallen, and continued at intervals of about three weeks up to within a week or two of fruit being picked. Arsenate of lead will also be found the most suitable spray for the control of pear-slug or leaf-roller. For leaf-roller attacking stone-fruits, arsenate of lead should be applied as for pip-fruits, except for the cutting-out of the calyx-spray, which is not necessary.

In regard to sucking-insects, if red mite appears during the month apply lime-sulphur at about 1–100. This will not only deal with red mite but also be very beneficial as a fungicide. To control woolly aphis probably the best result will be obtained by an application of Black-leaf 40, at a strength of 1–800. Be sure to use plenty of force to drive it into the colonies. This wash may safely be combined with arsenate of lead for the control of codlin-moth. For green and black aphis spray as soon as noticed with Vistolene or Katakilla. The trees most likely to be attacked with these pests are peaches, nectarines, and Japanese plums. A careful watch should be made to catch the aphis before it becomes too numerous.

For fungus diseases attacking the apple, once the fruit has set growers are advised to spray with lime-sulphur in preference to bordeaux, as the latter is liable to russet the fruit. Lime-sulphur is probably superior to bordeaux in the control of powdery mildew, and will help considerably in preventing black-spot. Lime-sulphur may be combined with arsenate of lead, but owing to the amount of scorching that has taken place during the last few seasons it is recommended that, if possible, they be applied separately. As regards pears, continue spraying with bordeaux, summer strength, for the prevention of scab.

Thinning is a most important part of an orchardist's work, especially those growing stone-fruit. Thinning helps considerably in giving the orchardist regular crops of first-grade fruit, instead of an exceptional crop one season, with a big percentage of seconds, followed with a light crop of overgrown fruit. Also if the fruits are well spaced by thinning, brown-rot and leaf-roller are more easily controlled.

Cultivation should be continued to conserve soil-moisture and keep down weeds. Stirring of the soil is the chief necessity at this time of the year.

Newly planted orchards should be carefully gone over from time to time, and any shoots that are pushed out from the stalk of the tree should be disbudded—that is, from below the point from which the framework of the tree is to be built up. This will ensure the whole strength of the tree going into the correct channels.

—*W. J. Courtier, Orchard Instructor, Christchurch.*

NOTE.—A commencement with Otago District notes is deferred till next month.

POULTRY-KEEPING.

By F. C. BROWN, Chief Poultry Instructor.

MANAGEMENT OF YOUNG STOCK.

NOVEMBER should see the full number of chickens already hatched out if they are to be developed into profitable stock, as birds brought out later than this are always disappointing, and, in fact, one is usually better without them. It must not be thought, however, that because hatching operations have ceased the poultryman can have an easy time; indeed, November is one of the busiest months of the year. It is then that the maximum amount of stock the plant can carry should be on hand, and therefore the greatest call is made on good management to handle the mature and developing stock to the best advantage.

Every care should be taken to make the houses fit to receive the young stock after they leave the brooder, and guard them against

receiving any set-back. Not only should the houses be well cleaned before the young birds are placed in them, but they should be thoroughly sprayed with a good disinfectant, or given an application of white-wash or tar. Where adult stock have recently been kept in the quarters intended for the chickens the work must be effectively done, as there are few poultry-houses that are quite free from vermin. Because vermin cannot be seen in the house they are not necessarily absent. Some of the most troublesome parasitic pests of the fowl, such as red mite, work at night and hide themselves by day. All crevices and hiding-places should therefore be thoroughly sprayed or covered up with tar.

Do not allow the chickens to huddle in the corners when first removed from the brooder, or trouble may be safely anticipated. The crowding induces sweating, and once this takes place the young ones will cease to thrive. To prevent this trouble a temporary hover made out of sacking should be provided for the chickens to sleep under. This is not necessarily with the object of keeping them warm, but rather with a view to giving the chickens seclusion, which they naturally look for after leaving a closed-in brooder. It is essential that the hover be arranged in such a way that the birds can secure an ample supply of fresh air. Never overcrowd chickens at this stage; it is one of the fatal mistakes made by poultrymen. The chickens should be provided with a bed of straw or pine-needles, &c. Allowing chickens to sleep on a hard floor is a common cause of crooked breast-bones. Another and probably the most common cause of this trouble is allowing the young birds to perch too early. Especially is this the case when small round perches are used; the best perch for a growing chicken is a board about 6 in. wide. Where possible, chickens should have a piece of fresh ground to run over when they leave the brooder —a run that has been sown down and spelled for some time. Usually the young birds will grow much better on such a run compared with their growth on stale ground or where adult stock have had access.

It is important that the sexes be separated as soon as the sex can be determined, or, at any rate, before the cockerels commence to crow. This will be to the advantage of the pullets, and will earlier enable the cockerels to reach the desired table condition. Cockerels intended for market purposes should be given much different treatment from that of pullets. If the cockerels are to be well fed in order to market them at the right time and in a prime condition the pullets will be unduly forced. Cockerels should be rapidly developed, and to this end should have restricted range and a forcing diet, whereas the pullet should have a good range and an ample but a plain ration. In other words, the cockerel demands artificial conditions, and the pullet as natural conditions as possible. It will pay to feed early-hatched cockerels well and have them prime for the Christmas table trade, as they are sure to command high values at this time. If a cockerel is to prove really profitable it must be well fed from the start, and marketed when from four and a half to five months old. Of course, the selected cockerels for breeding purposes should be treated in a similar manner to the pullets. They must be kept steadily growing in order that they may have the desired stamina and constitutional vigour. This can only be secured by liberal feeding of the right class of food and providing as much range as possible. On no account must pullets be forced to premature development. When it is observed that this is taking

place all forcing-foods, such as meat, milk, &c., should be cut out of the ration and a plainer diet substituted. In this case a good plan is to chiefly confine the ration to good plump oats (crushed for preference) and an abundance of green stuff. It is surprising the amount of green food the young birds will eat to their own advantage; also to the interest of the owner's pocket, as a liberal ration of green material will induce the birds to eat less of the more expensive foodstuffs.

Young stock will not do well in the absence of shade at this period of the year. Where natural cover has not been provided some temporary arrangement for shade should be made without delay.

FEEDING TO THE BEST ADVANTAGE.

Of the many mistakes made in connection with present-day poultry-keeping the most common of all is to expect fowls to be profitable when they are not fed to the very best advantage. Time and again the advice has been given in these pages that the heavy layer cannot be overfed with food of the right quality. Cases have recently come under my notice where flocks of noted laying-strains were being kept and yet the egg-yield was very disappointing, simply because the ration provided was merely sufficient to keep the birds alive. One owner admitted that he was afraid to give the birds all they could eat for fear they would become too fat. In another case the flock were given a scant ration, as it was considered that with the present high cost of foodstuffs there would be no margin of profit if the birds were given even a decent meal. Needless to say, none of the birds were laying, and in the circumstances it would have been surprising if they had been. Unfortunately, when fowl-food is dear there is always a tendency on the part of many poultry-keepers to underfeed their flocks. It is safe to say that many thousands of birds at the present time are kept on a merely living-ration, and do not return their owners the profit they should. For successful poultry-keeping economy is just as essential as in any other line of business, but to stint fowls of their food is practising economy at the wrong end! It should be remembered that eggs are a surplus product of the fowl, and are chiefly manufactured from the food eaten by it. It is therefore impossible for a hen to produce 2 oz. eggs day after day and at the same time maintain her bodily health if not supplied with an abundance of good nourishing food. The price of foodstuffs is certainly high, but when only well-selected stock are kept they will yield a good margin of profit over cost of production, providing, of course, that good management goes hand-in-hand with good feeding. The fact of dear food does not imply that it should be given in less quantity, but rather that all inferior stock should be culled out, while at the same time every endeavour should be made to use substitutes for dear grain. In feeding poultry it should also never be forgotten that the poorer the quality of the food the greater must be the quantity supplied.

In this connection the growing of a patch of lucerne is strongly recommended. The value of this highly nitrogenous plant as a poultry-food has been demonstrated by the results obtained in the feeding experiments conducted by the Department at the Milton Poultry-station. Lucerne is one of the most popular poultry foods in America. It serves a dual purpose, inasmuch as it can be fed as a green food

during the greater part of the year, while any surplus can be easily made into hay for winter use. Finely chaffed lucerne hay steamed overnight and mixed in the morning mash not only has the effect of making the mash more appetizing to the birds, but also tends to promote egg-production, while it also replaces to a great extent more costly foods, and thereby effects desirable economy. There are few soils in the Dominion where it cannot be grown, and there is no reason why the great majority of those who keep poultry should not have this food in continual supply. Dry lucerne chaff when ground into meal is also an excellent food for poultry. When this material is available it will to a great extent provide a substitute for ground grains, pollard, &c., when making the morning mash; it may also be used to advantage in a dry-mash formula. It is not to be supposed that an inferior quality of lucerne chaff or meal is of any more value than a poor quality of wheat or oats, &c., for feeding fowls. I have seen lucerne chaff sold to poultrymen which was more like chaffed dry sticks than the genuine article. The object of the Department in conducting experiments and bringing under the notice of poultrymen the value of lucerne for poultry was to encourage them to grow it themselves, but as yet few seem to be making any attempt to do so. Red clover is another fodder plant that may be grown by the poultry-keeper, and fed to advantage in a similar manner to lucerne.

THE APIARY.

By E. A. EARP, Apiary Instructor.

SWARMING.

By November, if the weather conditions are favourable, swarming should be in full swing throughout the Dominion. Therefore it is most important that the beekeeper should note the condition of his hives in ample time to decide which colonies are to be allowed to swarm. Excessive swarming is often accepted by beginners as a proof of prosperity, but this cannot be regarded by any means as an established fact. Only strong colonies headed by young vigorous queens should be allowed to swarm, and in many cases it will be found that these colonies show little inclination to do so. Where a colony of moderate dimensions persists in making preparations for swarming it should be deprived of its queen-cells at frequent intervals, and should be requeened from better stock at the earliest opportunity. When a strong colony swarms, the swarm should be hived at once into a clean box, which should be stood on its side in a cool place, covered with a sack, in such a manner that the bees may pass in and out of the box easily, and be left there ti towards evening. By that time a hive should be prepared containing frames fitted with full sheets of foundation, and, if necessary a feeder. Place this on its permanent stand. Late in the afternoon the hive-body should be raised from the bottom-board and a clean sack laid on the alighting-board and surrounding earth. The bees should be dumped from the box on to the sack, when they will crawl into the hive. If honey is not coming in freely,

or if bad weather supervenes, the swarm must be fed with syrup prepared from sugar and water, in the proportions of 1 to 2, so that the bees may commence comb-building at once. Excellent combs are made from sugar syrup, and within two or three days the bees should have drawn out several combs and the queen be busily engaged filling the cells with eggs. If possible, always use foundation when hiving a swarm. The bees in a swarm are prepared for comb-building and will simply waste a lot of wax if placed at once on drawn-out combs.

If the beekeeper has any reason to suspect the hive to be diseased from which a swarm issues, he should leave the swarm in the box into which he has hived it for at least three days, in order that the bees may use up the honey they will have brought with them when they left the parent hive.

After the swarm has issued the parent hive should be thoroughly examined, so that the queen-cells may be removed. Every cell except two of the best should be taken away. Where the hive contains particularly good stock, and the queen-cells are large and ripe, they may be carefully preserved and placed in nuclei for the purpose of queen-raising. Very often the best queens in the apiary are procured by this means. When the swarm has been placed in its permanent hive the frames should be carefully covered by good mats. Neglect of this precaution even for two or three days will often result in the bees building comb right into the roof, especially where gable-roofs are used, thereby wasting much good material as well as making the hive difficult to open.

After-swarms.—It often happens that in spite of all precautions strong colonies will throw an after-swarm within a few days of the issue of the prime swarm. Sometimes the prime swarm will be delayed by bad weather, in which case the bees may have kept the virgin queens in their cells until the laying-queen has left the hive, only to liberate them immediately after, and before the apiarist has time to examine for queen-cells. These queens, being small and quick-moving, are very difficult to detect, and will probably escape notice altogether. In this case the after-swarm may follow very quickly after the prime swarm. Occasionally, too, a few queen-cells may be missed in cutting out. If they are built, as frequently happens, on the edge of the comb against the side of the frame they are very easily overlooked. After a little observation an after-swarm can often be detected by its behaviour. A laying-queen is heavy with eggs, and will usually seek a resting-place without delay and without venturing too high from the ground. Sometimes, indeed, she falls to the earth, and the bees will be unable to find her and will return to the hive. However, she will usually alight in some convenient spot, and the bees will cluster round her with amazing rapidity. When the hives are scattered instead of being in regular rows, a beekeeper working in his apiary at a distance from a swarming hive may miss the whole operation of the issuing of a prime swarm unless the noise attracts his attention, so quickly, as a rule, do the bees settle with a laying-queen.

With one or more virgin queens in a swarm matters are usually different. The queens are small and light, and will often soar to a considerable height, choosing their own time about settling. If there are two or three queens in a swarm there will probably be as many divisions in the cluster, so that instead of forming one compact heart-

shaped mass the swarm may hang for a considerable time in several peaks. Care should be taken to see that every section is shaken into the box. A simple method of dealing with after-swarms is to place an excluder between two empty hive-bodies, the lower of which rests on the ground or a bottom-board. Shake the swarm on to the excluder, when the bees will go through the holes in the excluder, and the queens may easily be distinguished and removed. When the queens are gone the bees will return to their parent hive, and the queens may be utilized for replacing old and failing queens. There need never be any doubt as to the advisability of taking every queen from an after-swarm—there will inevitably be one queen left in the hive for the bees to return to.

ARTIFICIAL INCREASE.

This may be accomplished in several ways, but perhaps the most satisfactory is by means of nuclei and division. A nucleus is best formed of two frames of emerging brood and young bees, one frame of honey and one containing pollen. This must be completed by a virgin queen or a ripe cell. The nuclei may be utilized throughout the season for the mating of queens for renewal, and at the end of the summer, if two or more are united or if each one is reinforced by the addition of bees and brood from strong colonies, they may be wintered in safety and will form good stocks for the next season. No surplus can be expected from them the year of their installation. In dividing it is best to wait till the colony is preparing to swarm and ripe queen-cells appear in the hive. The hive can then simply be split in two by putting half the bees and brood on another stand, taking care to leave queen-cells in each division, and for preference putting as much emerging brood in the half which is to be placed in a new position. This latter precaution is necessary in order to make up the wastage from the field-bees that will return to the old stand. Each hive can then be completed by filling the vacancies by drawn-out combs. The queen-cells in the queenless half will be nursed by the young bees, while those in the half containing the queen will be torn down by the bees when they find the hive depleted. If the apiarist wants to be quite sure of this being done, he may search for the queen and remove her while the division is being made, afterwards putting her in the hive on the new stand. The division method is advocated on account of its simplicity and the fact that there is no necessity for finding the queen before the operation. It is a most effectual preventive of swarming, and saves a great deal of trouble where increase is desired.

SUPERING.

In most districts November is early enough for the employment of supers, though much depends on weather conditions. If the weather is warm, the hives full of bees, and nectar coming in freely, the supers may now be added at any time. However, it is of no use discouraging the bees by giving additional space before the weather is warm enough to justify it. If increase is required it is as well to confine the bees to one story till the hive is overflowing with bees. This is almost certain to produce a desire to swarm, and the hive can either be allowed to swarm naturally or be divided artificially. When the first super is put on it is best, if possible, to fill it entirely or partially with drawn-out combs. If only foundation is available, one

or two combs—*not containing brood*—may be removed from the bottom story to the top, and sheets of foundation put in their place. On no account disturb the brood until settled weather eventuates. If foundation is used in the super, queen-excluders should not be used, as the bees will rarely travel through the excluders to work the foundation and will usually swarm. Do not bring excluders into use until the bees are quite accustomed to working in the supers.

CARE OF BEE-YARD.

Before the supers are put on it is advisable to see that the hives are raised well above the ground, so as to provide ventilation underneath and also to prevent them becoming a shelter for insects. The bottom-boards should be raised at least the height of a brick from the ground, and they may even be a little higher, though in the latter case the alighting-board should be long and sloping to enable the heavy-laden workers to reach the hive easily if, as so often happens, they miss the entrance when descending at the end of their homeward flight. All grass and weeds should be cleared away from the hives, particularly at the entrances. To save the continual labour of this operation during the spring and summer it is a good plan to skim the weeds from the ground and to spread agricultural salt in the proportion of about 6 lb. per hive, to prevent their reappearance for the season. Although this is only a temporary remedy, it should save mowing the grass for at least one season. Whatever the labour, the entrances must be kept free; the bees' lives are all too short and arduous, and the energy wasted in forcing their way through the tangle of weeds sometimes seen in apiaries must amount to a good deal in the course of a season.

VITICULTURE.

By S. F. ANDERSON, Vine and Wine Instructor.

THE VINEHOUSE.

In regard to vinehouse work there is little to add to the notes which appeared in the August issue of the *Journal*. The treatment there described may be continued in November.

THE VINEYARD.

As the time when the control of the apparently excessive growth of the vine is approaching, some remarks on the best system to adopt in this branch of pruning will be in place The vine prepares its food by means of the green colouring-matter (chlorophyll) of its leaves. All the starch, sugar, and other substances which make up the body of the vine and of its crop are elaborated by means of the chlorophyll under the influence of sunlight. The carbonic acid of the air and the water from the soil furnish the main bulk, while the mineral salts from the soil are a small but equally necessary part. A certain area of green leaf surface, functioning for a certain time, is necessary to produce sufficient nourishment for the vital needs of the vine, and for the production of the crop. Those leaves most exposed to the direct rays of the sun

are most active in absorbing and producing food. The youngest take all their nourishment from the older parts of the plant, and a young shoot may thus be looked on as, in a sense, parasitic upon the rest of the vine. The true feeders of the vine and of its crop, therefore, are the mature dark-green leaves. This principle shows that any method which forces an unnecessary growth of young shoots, or removes mature leaves while still active, limits the possibilities of production, and if carried too far may result in starvation of the vine. The growth of the vine in New Zealand vineyards is very strong, owing to our moist climate. Topping has therefore to be done to keep the vine within reasonable limits to permit of cultivation. Topping is very simple, and can be done by any ordinary person after a little instruction. It consists in cutting or breaking off the terminal shoots of the vine from time to time. It is applied to all outdoor vines with some variation. An ordinary reaping-hook or large knife is what is generally used. This topping is, however, very often carried to excess or very carelessly done, thus seriously affecting the future vigour of the vine and eventually leading to a starvation of the plant. Before proceeding to top see that the growth made from the two spurs left on the crown of the plant is first tied down along the top wire, so that these spurs are not cut when topping those growing upright from the rod on the bottom wire. This stage of the vine's growth was illustrated on page 203 of the *Journal* for March, 1917.

CELLAR WORK.

The temperature will now be increasing, calling for extra watchfulness from the winemaker, among the new wines in particular. The dry westerly winds may now be causing considerable evaporation, so that all casks will require filling. If the shed or building in which the wine is stored has a galvanized-iron roof the temperature of the inside can be maintained several degrees lower by painting the outside with a whitewash prepared as follows: Slake half a bushel of quicklime with boiling water, keeping it covered during the process; strain it, and add one peck of salt, 3 lb. ground rice, 1 lb. glue, and ½ lb. whiting; dissolve the salt and glue in hot water, and boil the rice until a thin paste is formed; mix the whole well together, and let the mixture stand for several days. Keep the wash thus prepared in a portable boiler, and when used put it on hot with a whitewash-brush.

THE GARDEN.

By W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

TOMATOES: Early in November is the best time to plant in most places. There is a very general desire to plant earlier than this, it being thought that early planting will result in correspondingly early fruit. Usually, however, the reverse happens. There are some few places where the absence of frost, and other favourable conditions, make early planting both safe and wise, but in general the results are not what are expected or hoped for. Many losses of a wholesale

nature have come under my personal observation that were entirely due to planting too early. The first necessity is well-grown and properly hardened plants, which will be independent of watering. Unless the plants lift from the boxes with a large ball of roots and soil they are not fit for planting. All too frequently the plants are hurriedly grown in warm houses and sent out without proper hardening. The result is that plants wither under sun heat unless they are well supplied with water, which indicates a soft, flimsy texture which watering makes worse. Such plants succumb to a few degrees of frost, or are destroyed by an untimely gale of wind, or if they survive they do not make thrifty plants. Any one who received such plants—with few roots and palpably soft—will be well advised to heel them in a sheltered place for a week or two before planting out. The lost time will soon be recovered by the better-conditioned plants. The most popular way of training at the present time is to lead the growths perpendicularly up a trellis composed of three wires tightly strained, the top wire being 3 ft. from the ground. The plants are set about 18 in. apart, and each plant is allowed two branches. Before they are set out the plants should be sprayed with 4–4–40 bordeaux, or the boxes of plants may be dipped in the mixture. When the plants make growth all the side shoots must be kept pinched out. Do this before they develop much, so as not to waste the plant's energy. As soon as an appreciable amount of growth has been made it should be sprayed, and from thence onward the foliage should be kept practically covered with a fungicide. Fresh lime is not always obtainable, and it is quite useless unless it is fresh. Washing-soda may take the place of lime; it is quite as effective and is always obtainable; 1¼ lb. of soda is equal to 1 lb. of lime.

Potatoes: Planting will now be about finished. Keep the ground well cultivated to prevent weed-growth, and to maintain the soil sweet, which really means admittance of air. As soon as the sets show through give a top-dressing of sulphate of ammonia spread along the rows in close proximity to the sets; ¾ oz. per lineal yard will be sufficient. Scuffle the fertilizer in, if possible. If the sulphate is not to be applied, blood-and-bone or dried blood alone should be given. This should be applied as early as possible, as blood manure is slow in action. Give a full ounce in place of the less amount of sulphate of ammonia. Potatoes are ready for the first moulding when the tops are about 6 in. high. Before moulding they should be sprayed with 4–4–40 bordeaux.

Gourds: Pumpkins, marrows, melons of all kinds, and cucumbers may be planted out, or seed sown in the open, early in the month. In very sheltered positions there is advantage gained by setting out plants raised earlier under glass; in such positions the plants grow away at once, and early fruit is obtained. In ordinary circumstances it is better to plant seeds; it effects a great saving of labour, and fruit is obtained almost as early. The difference will probably be about ten days in favour of the plants if the position is moderately sheltered, but if the weather should prove boisterous, or the position is without shelter, there will be no advantage. Deeply worked, fairly moist soil suits the gourd family best; very rich soil is not necessary. Stable or farmyard manure is beneficial more because it holds moisture than because of its manurial properties. In small gardens an excellent place to grow gourds is on a heap of garden-refuse, weeds, &c., or on a heap of manure stacked

for future use. All that is necessary is to throw on a few shovelfuls of free soil to plant the seeds in. The vines will cover up the heap and convert it into an ornament instead of an eyesore. The plants on a heap of garden-refuse will grow and bear as well as those on a manure heap—proof enough that it is moisture, not manure, they require. In ordinary practice those cultivators who grow good breadths of pumpkins, &c., prepare the soil by deep ploughing. Where manure is available it is beneficial, but a green crop ploughed under is probably quite as good. A dressing of blood-and-bone should be given, as although rich ground is not necessary it must not be poor. In small cultivations better results are secured by digging a hole about 2 ft. deep and equally broad, and three parts filling it with half-decayed manure or weeds, &c., returning the soil, and planting the seeds on top. When growing them on the flat the plants should be set in clumps of three, 10 ft. apart. A few extra seeds should be set in each clump to allow for possible loss, thinning the plants if more come than are wanted, but not until they have made sufficient growth to ensure their safety.

Celery: Trenches are necessary for the production of first-class heads. These are prepared by digging out the soil one spit deep and placing it in the intervals between the trenches, which must be 3 ft. apart for single-row trenches, and 4 ft. apart for double-row trenches. For single rows—which give the best heads—dig the trench as narrow as a No. 1 spade will make it. For double rows the trench must be half as wide again. When the first spit has been thrown out, dig a good layer of half-decayed manure into the bottom. The trenches are best prepared some time before they are wanted, so as to allow time for the soil and manure in the bottom to settle and aerify.

Other vegetables: Parsnips and carrots should now be sown for winter use—therefore in quantity. Superphosphate is a useful fertilizer; apply from 1 oz. to 2 oz. per square yard according to the quality of the soil, if any is needed. Wood-ashes are good in any case, and may be applied at 7 lb. per square rod. The best land for these vegetables is that which was well supplied with stable manure for a previous crop, in which case no fertilizer, unless it be wood-ashes, will be needed. At this time of the year seeds come freely, and if the ground has been kept clean there should be very little trouble with slugs. This renders thin sowing possible, and saves a large amount of labour in thinning. Drop two or three seeds at intervals of about 4 in. and thin to one when the plants appear. Sow peas and French beans for succession. Plant cabbage, cauliflowers, and lettuces according to requirements. Sow turnips seven or eight weeks after the last sowing. Sow lettuce in drills, and thin the plants instead of transplanting. Sow radishes every ten days in small lots. Onions for pickling should be sown during the last half of the month, silver-skin varieties being best for the purpose. Choose a rather poor patch of friable soil, and before sowing the seed tread the soil very firm. Sowing may be broadcast if weeds are not likely to be troublesome, otherwise sow in wide drills, distributing the seed so that each is clear of another. No thinning should be done. Cabbage, savoys, and all broccoli, as well as varieties of kale where these are grown (these being most useful in the colder parts of the Dominion) should be sown during the month, but not until the 20th in northern districts.

SMALL-FRUITS.

Strawberries.—No runners should be allowed to form while the plants are fruiting, but should be pinched off as soon as they are seen. This refers, of course, to the main crop. In some places the plants give smaller quantities of fruit after the main crop is gone. If fresh plants are required the runners should be stopped when they have formed two plants. They are not able to produce them later with strength enough to make good fruiting-plants for the next season. When only a comparatively small number are wanted, one to each runner will be better than two, though it is safe to allow two. Disappointment follows the use of late-formed runners.

Cape Gooseberries.—I have often stated that these plants should be raised in late autumn, not in spring; but I notice most people raise them in spring. The plants grow quickly, and it is as easy to get sizable plants from spring sowing as it is with tomatoes. My experience is that the autumn-raised plant gives by far the best crop the first season. The plants may be now set out. I prefer to plant three in a triangle, the plants in the triangle about 6 in. or 8 in. apart, and the clumps 5 ft. apart. Planted in this way the growths interlace and no amount of wind will disturb them; they also stand up better than when planted singly. Single plants assume a drooping habit and sprawl about on the ground.

Gooseberries.—No attention to the bushes is needed at this time except to break out any gross shoots that may appear, particularly if they be near the base and are going up through the centre. These shoots are now quite soft, and it is easy to tear them out from their sockets, which entirely destroys them; whereas if they are simply cut back, or left till the winter pruning and then stubbed back, there are always a number of other shoots springing from the base and causing a lot of trouble. The same remarks apply to red currants, but not to black currants, on which latter such shoots should be encouraged.

LEADING PEN OF WHITE ROCKS IN LAST MILTON FEEDING-TEST.

ANSWERS TO CORRESPONDENTS.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

CONTROL OF GRASS-GRUB.

"GRASS-GRUB," Invercargill:—

Kindly state the best method for getting rid of the grass-grub. I noticed in one paddock recently that the grub seemed to be everywhere one looked, about 2 in. or 3 in. in the soil. But they did not seem to have affected the grass in the least. This paddock is now being worked for turnips.

The Fields Division:—

There is really no satisfactory method of dealing with the grass-grub, other than by following certain cropping practices. If ground is well worked throughout October the majority of the grubs, which are there in the pupa stage, are killed. If a crop of rape is then sown the grazing with sheep will have a considerable influence on stopping egg-laying and in killing young grubs. It has been repeatedly noticed that grass laid down with rape escapes grass-grub attack to a very considerable extent. The growing of turnips is also very satisfactory in controlling grub, especially if the land is kept well horse-hoed during the season. As a general rule, in Southland grass-grub is most prevalent in grass land that has been down for two or three years, and is not so bad in young grass as it is farther north, where the grass is sown either earlier in the spring or later in the summer than it is in Southland. Wherever grass-grub is bad grass should be laid down with rape, and sown from the middle of October to the middle of November.

RAISING PINE-TREE SEEDLINGS.

"PINUS," Waiuku:—

Kindly inform me in regard to the proper method of raising seedlings of the *Pinus* family.

The Horticulture Division:—

Seeds of pine-trees may be sown in spring in clean, well-prepared friable soil in the open. Sow in drills about 1 in. deep. It may be necessary to cover the beds with canvas-covered frames to protect the seedlings from frost or fierce gales, but this is a matter depending on local conditions. In the autumn, about March, when the young trees have grown sufficiently, the tap-roots should be cut by thrusting a sharp spade under the rows of seedlings from each side. The seedlings will be ready for lifting about a month later, when they may be planted out permanently or into nursery rows. The seeds do not require any treatment.

REMEDIES FOR COW-POX AND LOSS OF CUD.

"SUBSCRIBER," Dalefield:—

Kindly advise me of some cure for cow-pox—the teat festering about tw weeks after calving, mostly in heifers; also a remedy for loss of cud.

The Live-stock Division:—

For the cow-pox trouble wash the teat with warm water, and apply twice daily, after milking, an ointment of extract of belladonna and lanoline, of each ½ dram, made up to 1 oz. with vaseline. For loss of cud try a dose of salts, ¾ lb. to 1 lb., in a quart of warm ale.

GROWING FIELD-CARROTS.

"SUBSCRIBER," Waipawa :—

Regarding the growing of carrots for stock, kindly let me know the right quantity to drill per acre, also the best kinds, and the right manure to use for good heavy land.

The Fields Division :—

Our practice at the Central Development Farm (Weraroa), on land such as you describe, is to sow 4 lb. per acre with the ridger, the rows being 28 in. apart. A mixture of 1½ cwt. superphosphate and ½ cwt. blood-and-bone per acre should be a sufficient manuring. Sinclair's Champion and White Belgian are probably the heaviest croppers on good land. To ensure rapid even germination it is advisable to run a light roller over the ridges after sowing.

STRAW-ASHES FOR FERTILIZER.

"SOUTH CANTERBURY," Cave :—

I would like to know the value of ashes gathered after burning straw-stacks. I have just bagged up eight sacks of ashes weighing about 1 cwt. each. If I mixed about 2 cwt. of lime with this after riddling the ashes so as to sow through a drill, do you think this would do to sow with the rape and swedes instead of the manure we usually sow, and, if so, how much of this mixture should be sown to the acre ? We sow about 1 cwt. to the acre of the manure we buy.

The Fields Division :—

Straw-ashes contain anything up to 5 per cent. of phosphoric anhydride, in addition to some potash and lime. To approximate to an ordinary phosphatic manure for rape and turnips, over three times the usual quantity for such manure would have to be used. The addition of lime would not be of advantage unless the soil were specially lacking in that ingredient, which should not be the case with you. It is suggested that you mix your ashes with superphosphate in equal proportions, and use 1½ cwt. per acre of the mixture for turnips. For rape make up a mixture as follows : Ashes, 2 parts ; super, 2 parts ; blood-and-bone, 1 part, and use 1½ cwt. per acre of the mixture.

MAIZE-GROWING FOR NORTHERN HILL COUNTRY.

"BRACKEN," Hokianga :—

What is the best variety of maize to sow for cob on heavy-clay hill country ? How much seed is usually sown per acre, and what is the best manure to use ?

The Fields Division :—

Early Yellow Leaming would be a suitable variety. About 1 bushel to 4 acres is the usual rate of seeding. With rows 3 ft. apart, this would give a spacing of about 10 in. between plants in the row. For manure a mixture of superphosphate and blood-and-bone manure, in the proportion of two parts of the former to one of the latter, the mixture being used at the rate of 2 cwt. per acre, is recommended.

COLOUR OF INDIAN RUNNER DUCK-EGGS.

"POULTRY," Masterton :—

Kindly advise me what is the true colour of the eggs of the purebred Indian Runner ducks, and do the green eggs signify that the stock is impure ? I have had sittings from two different breeders, and while the eggs from one were all white, the eggs from the other were a mixture, half green and half white.

The Live-stock Division :—

The colour of the eggs produced gives no indication whatever as to whether the birds conform to standard requirements or not. Both green- and white-shelled eggs will be produced from the best flocks of purebred stock.

COMPARATIVE FEEDING-VALUE OF MANGOLDS AND CARROTS.

O. T. PARRY, Manaia :—

Would you kindly let me know which has the most feeding-value for dairy cows when in milk—either an acre of Yellow Globe mangolds or an acre of Magnum Bonum carrots, allowing both roots to be a first-class crop ?

The Fields Division :—

In total food nutrients produced Yellow Globe mangolds will considerably exceed Magnum Bonum carrots on the same average soil, and (provided they are not to be used until matured) should be preferred.

BUCKWHEAT.—WILD WHITE CLOVER.

R. M., Manapouri :—

Can you give me any points in regard to the cultivation of buckwheat ? We have about five months free of frosts. Is it of any value as green fodder, even if cut in the early stage, or would you recommend Cape barley instead ? Would you advise sowing *Lotus angustissimus* with either crop, chiefly to cut for cow-feed ?

Can I procure any seed of *wild* white clover ? If so, where, and at what price ?

The Fields Division :—

Buckwheat is grown for its grain, which is valuable chiefly for producing a special flour, but there is little demand for it in this country. Odd lots of buckwheat are grown for poultry-feed. For cow-forage, oats or barley far surpass buckwheat. The best seeding for this purpose under your conditions would be 2 bushels of oats and 1 bushel golden tares. *Lotus angustissimus* is not considered suitable for the purpose.

The white-clover seed harvested from old pastures is identical with the wild white-clover seed of commerce. Most of the Hawke's Bay white clover is of this description. It can be procured through any seed-merchant.

CONTROL OF CRICKETS.

C. P., Carterton :—

Orchardists in some places northward of Auckland are suffering from a pest of crickets attacking their lemon-trees. What should be done to stop the damage ?

The Horticulture Division :—

The suppression of crickets is a very difficult proposition, and it is likely to remain so until more land in the affected districts is brought under cultivation. Poisoning methods are practised in America, but to be of much use there must be co-operative efforts. A poisoned bait known as "criddle mixture" is the most simple that is in use, and is recommended for trial. It is made up as follows : Five pails of fresh horse-manure moistened with one pail of water, with 2 lb. of salt and 1 lb. of paris green throughly mixed therewith. The mixture is best applied with a trowel or small shovel where the crickets are thickest, and along fences, where they are prone to collect. Burning-over, where possible, is also recommended. It must be understood that the mixture is poisonous to cattle. The trunks and large branches of the trees may to a large extent be saved by painting them with a strong solution of lime-sulphur amalgamated with tobacco-dust. Spraying with lime-sulphur would be likely to have some effect in protecting foliage, using a strength of 1 in 100 to 1 in 120, according to the state of the foliage. Young leaves would probably be burned by the stronger solution.

SUDAN GRASS.

G. P. JACKSON, Norsewood :—

Kindly let me know whether Sudan grass is suitable for hay ; which soil is most suitable for it—damp clay or dry loam ; how many pounds of seed are required to sow 1 acre ; and if the climate of this district is suitable for it.

The Fields Division :—

Sudan grass makes good hay, but its feeding-value is inferior to that of ordinary meadow hay, a remark, however, applicable to most hay made from a single kind of plant. Dry loamy soil is more suitable than a damp clay for Sudan grass. It, however, grows well on cold clays, provided not sown too early. On a damp cold clay it would be best not to sow till about the second week in December. If the seed is of good germination 12 lb. to 15 lb. per acre is sufficient. The seed, however, is generally of poor quality, and from 18 lb. to 25 lb. should be used. Your district should be suitable for this grass.

SILVER-POPLAR SUCKERS.

B. L. S., Gisborne :—

I have a paddock which is overrun with suckers of silver-poplar, the parent tree having died. The suckers have already been dealt with by cutting and grubbing, but it seems to be impossible to eradicate the pest. Kindly advise as to the best means of effectively getting rid of them.

The Horticulture Division :—

There is no practicable way of clearing ground of the suckers of silver-poplar but trenching them out.

CONTROL OF GRAIN-WEEVIL.

"WEEVIL," Okete :—

I have a quantity of fowl-wheat which is attacked by weevils. Would you please inform me as to the best way of destroying them ?

The Fields Division :—

Weevil can be destroyed by fumigation with carbon bisulphide. This, however, requires an airtight box or other receptacle in which to place the wheat. The amount required is 1 lb. carbon bisulphide for each 60 bushels of grain, and the fumigation should last twenty-four hours. Grain can also be freed of the pest by heating it to 140° F. for four hours, but this method is rarely practicable. If the amount of wheat is moderate your best plan would be to use it as soon as possible, and then thoroughly clean out the shed or barn in which it has been stored, spraying the floors and walls with a disinfectant, such as Kerol 1 to 20, and repeating the operation in about ten days. When again storing grain in the same place allow plenty of ventilation between the sacks.

PIG WITH EAR TROUBLE.—PEA IN COW'S TEAT.

W. L. MALCOLM, Makotuku :—

I have a breeding-sow which for the past two months has been holding her head on one side as though she had something in her ear. I have just weaned her young, and two of them are similarly affected, only in a worse form, as they stagger about. They take their food all right. Could you indicate a cure ?

2. Is there any way of removing from a cow's teat a kernel that is blocking the flow of milk ?

The Live-stock Division :—

1. Get a mixture consisting of 1 part salicylic acid and 80 parts olive-oil, and pour some of this into the sow's ear. Slightly heat before the fire before using, otherwise its application will cause the pig to shake most of it out.

2. A "pea" or "kernel" in a cow's teat is generally the result of contagious mammitis. Before trying to remove it you had better send a specimen of milk to the Officer in Charge, Veterinary Laboratory, Wallaceville, for examination. If it is due to results of contagious mammitis it is better left alone.

NOTE.—A letter forwarded to H. Morton, Dunrobin, Otago, regarding his inquiry, has been returned through the Dead-letter Office.

ANNUAL SHEEP RETURNS, 1918 (30TH APRIL).

TABLE I.—SUMMARY BY SHEEP DISTRICTS.

—	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago (including Southland).	Total in Dominion.
Stud rams	646	1,487	3,756	633	2,441	2,969	11,932
Other rams	23,201	81,294	71,748	15,873	67,463	53,600	313,179
Wethers	330,156	858,059	944,843	189,731	622,092	751,639	3,696,520
Breeding-ewes	935,801	3,131,274	2,778,978	715,150	3,006,698	2,454,133	13,022,034
Dry ewes	149,162	552,801	404,689	46,403	225,348	220,346	1,598,749
Lambs	574,509	2,202,240	1,713,634	406,044	1,495,013	1,504,448	7,895,888
Totals, 1918	2,013,475	6,827,155	5,917,648	1,373,834	5,419,055	4,987,135	26,538,302
Totals, 1917	1,983,510	6,732,883	5,850,735	1,364,469	4,718,026	4,620,763	25,270,386

TABLE II.—COMPARATIVE STATEMENT: TEN YEARS, 1909–18.

Year.	Stud and Flock Rams.	Stud Breeding-ewes.	Stud Dry Ewes.	Stud Lambs.	Total Stud Sheep and Flock Rams.	Flock Sheep, and Sheep of Distinctive Breeds not entered in Flock-books.				Grand Total, Stud and other Sheep.
						Wethers.	Breeding-ewes.	Dry Ewes.	Lambs.	
1909	298,918	222,799	14,192	153,948	689,857	3,427,994	12,147,547	1,001,067	6,214,242	23,480,707
1910	305,569	227,187	13,943	160,234	706,933	3,167,082	12,288,193	1,194,570	6,912,842	24,269,620
1911	297,898	229,709	14,117	163,899	705,617	3,342,281	12,094,754	1,298,343	6,555,125	23,996,126
1912	306,588	232,782	11,563	155,498	706,431	3,359,969	12,044,247	1,324,200	6,315,306	23,750,153
1913	313,690	228,145	12,902	167,605	722,342	3,207,550	12,292,891	1,150,805	6,818,222	24,191,810
1914	321,869	229,055	13,526	170,169	734,619	3,211,661	12,691,121	1,152,749	7,008,613	24,798,763
1915	315,251	237,717	17,341	176,556	746,865	3,270,221	12,377,624	1,365,119	7,141,592	24,901,421
1916	316,131	252,201	15,012	175,155	758,499	3,478,263	12,640,566	1,189,023	6,721,799	24,788,150
1917	329,230	160,212	6,212	114,778	610,432	3,457,824	13,099,957	1,066,435	7,035,738	25,270,386
1918	325,111	171,437	6,297	125,116	627,961	3,696,520	12,850,597	1,592,452	7,770,772	26,538,302

NOTE.—Stud sheep returned for 1917 and 1918 are only those entered in flock-books.

TABLE III.—DISTRIBUTION OF THE VARIOUS BREEDS IN EACH SHEEP DISTRICT.

—	Auckland.	Napier–Gisborne.	Wellington–West Coast.	Total in North Island.	Marlborough–Nelson–Westland.	Canterbury–Kaikoura.	Otago.	Total in South Island.	Total in Dominion.
Stud sheep (entered in Flock-book)—									
Merino	..	..	..	..	3,147	7,377	4,894	15,418	15,418
Lincoln	3,070	5,434	35,326	43,830	1,033	1,656	1,631	4,320	48,150
Romney	9,240	16,312	62,195	87,747	7,920	6,994	28,581	43,495	131,242
Border Leicester	176	..	941	1,117	354	15,165	18,171	33,690	34,807
English Leicester	562	99	383	1,044	1,223	21,040	1,483	23,746	24,790
Shropshire	110	..	884	994	204	2,396	420	3,020	4,014
Southdown	519	3,698	11,412	15,629	143	7,880	685	8,708	24,337
Corriedale	..	..	..	..	23	24,845	5,820	30,688	30,688
Other breeds	..	129	248	377	..	955	4	959	1,336
Totals	13,677	25,672	111,389	150,738	14,047	88,308	61,689	164,044	314,782
Sheep of a distinctive breed but not entered in Flock-book—									
Merino	9,148	23,899	21,143	54,190	184,602	541,041	305,722	1,031,365	1,085,555
Lincoln	15,618	193,483	130,767	339,868	12,154	11,146	8,875	32,175	372,043
Romney	275,274	1,046,008	933,311	2,254,593	169,760	77,475	429,851	677,086	2,931,679
Border Leicester	2,457	1,874	4,898	9,229	1,776	77,492	107,270	186,538	195,767
English Leicester	2,687	697	1,627	5,011	13,926	128,351	8,169	150,446	155,457
Shropshire	3,412	399	1,299	5,110	1,517	8,688	3,367	13,572	18,682
Southdown	1,058	7,965	18,159	27,182	168	7,145	104	7,417	34,599
Corriedale	902	10,667	20,004	31,573	9,082	261,754	166,099	436,935	468,508
Half-breds	..	..	10,716	10,716	115,481	614,446	171,702	901,629	912,345
Other breeds	840	8,162	2,928	11,930	3,474	2,684	908	7,066	18,996
Totals	311,396	1,293,154	1,144,852	2,749,402	511,940	1,730,222	1,202,067	3,444,229	6,193,631
Crossbreds and others not otherwise enumerated	1,688,402	5,508,329	4,661,407	11,858,138	847,847	3,600,525	3,723,379	8,171,751	20,029,889
Grand totals ..	2,013,475	6,827,155	5,917,648	14,758,278	1,373,834	5,419,055	4,987,135	11,780,024	26,538,302

AGRICULTURAL SHOWS: SEASON 1918-19.

Hawke's Bay A. and P. Association: At Hastings, 16th and 17th October.
Amberley A. and P. Association: At Amberley, 17th October.
Poverty Bay A. and P. Association: At Gisborne, 22nd and 23rd October.
Wairarapa and East Coast P. and A. Society: At Carterton, 23rd and 24th October.
Ellesmere A. and P. Association: At Leeston, 24th October.
Kelso A. and P. Association: At Kelso, 30th October.
Manawatu and West Coast A. and P. Assn.: At Palmerston N., 30th and 31st Oct.
Timaru A. and P. Association: At Timaru, 30th and 31st October.
Northern A. and P. Association: At Rangiora, 31st October.
Canterbury A. and P. Association: At Christchurch, 7th and 8th November.
Bay of Islands P. and I. Association: At Waimate North, 8th November.
Marlborough A. and P. Association: At Blenheim, 12th and 13th November.
Waikato A. and P. Association: At Hamilton, 12th and 13th November.
Wanganui A. and P. Association: At Wanganui, 13th and 14th November.
Waimate A. and P. Association: At Waimate, 14th November.
Banks Peninsula A. and P. Association: At Little River, 19th November.
Nelson A. and P. Association: At Richmond, 19th and 20th November.
Wallace A. and P. Association: At Otautau, 20th November.
North Otago A. and P. Association: At Oamaru, 20th and 21st November.
Whangarei A. and P. Association: At Whangarei, 21st and 22nd November.
Wyndham A. and P. Association: At Wyndham, 22nd November.
Taieri A. and P. Association: At Wingatui, 23rd November.
Clevedon A. and P. Association: At Clevedon, 23rd November.
Otago A. and P. Society: At Dunedin, 27th and 28th November.
Stratford A. and P. Association: At Stratford, 27th and 28th November.
Auckland A. and P. Association: At Auckland, 29th and 30th November.
Gore A. and P. Association: At Gore, 3rd and 4th December.
Clutha and Matau A. and P. Society: At Balclutha, 5th and 6th December.
Palmerston and Waihemo A. and P. Association: At Palmerston, 6th December.
Maniototo A. and P. Association: At Ranfurly, 12th December.
Waikouaiti A. and P. Association: At Waikouaiti, 13th December.
Southland A. and P. Association: At Invercargill, 13th and 14th December.
Otago Peninsula A. and P. Association: At Portobello, 14th December.
Tuapeka Agricultural Society: At Lawrence, 26th December.
Nuhaka A. and P. Association: At Nuhaka, 1st January.
Wairoa County A. and P. Society: At Wairoa, 29th January.
Helensville A. and P. Association: At Helensville, 29th January.
Taumarunui A. and P. Association: At Taumarunui, 29th January.
Woodville A. and P. Association: At Woodville, 29th January.
Feilding A. and P. Association: At Feilding, 4th and 5th February.
Tapanui Farmers' Club: At Tapanui, 5th February.
Central A. and P. Association: At Waipukurau, 5th February.
Pahiatua A. and P. Association: At Pahiatua, 7th February.
Hukerenui Agricultural Association: At Towai, 12th February.
Dannevirke A. and P. Association: At Dannevirke, 12th and 13th February.
North Kaipara A. and P. Association: At Paparoa, 14th February.
Te Puke A. and P. Association: At Te Puke, 13th February.
Northern Wairoa A. and P. Association: At Aratapu, 15th February.
Whakatane A. and P. Association: At Taneatua, 19th February.
Waimarino A. and P. Association: At Raetihi, 20th February.
Egmont A. and P. Association: At Hawera, 26th and 27th February.
Franklin A. and P. Association: At Pukekohe, 28th February and 1st March.
Marton A. and P. Association: At Marton, 5th March.
Taranaki Agricultural Society: At New Plymouth, 5th and 6th March.
Ashburton A. and P. Association: At Ashburton, 19th and 20th March.
Matamata A. and P. Association: At Matamata, 20th March.
Strath Taieri A. and P. Society: At Middlemarch, 1st April.
Mackenzie County A. and P. Society: At Fairlie, 21st April.